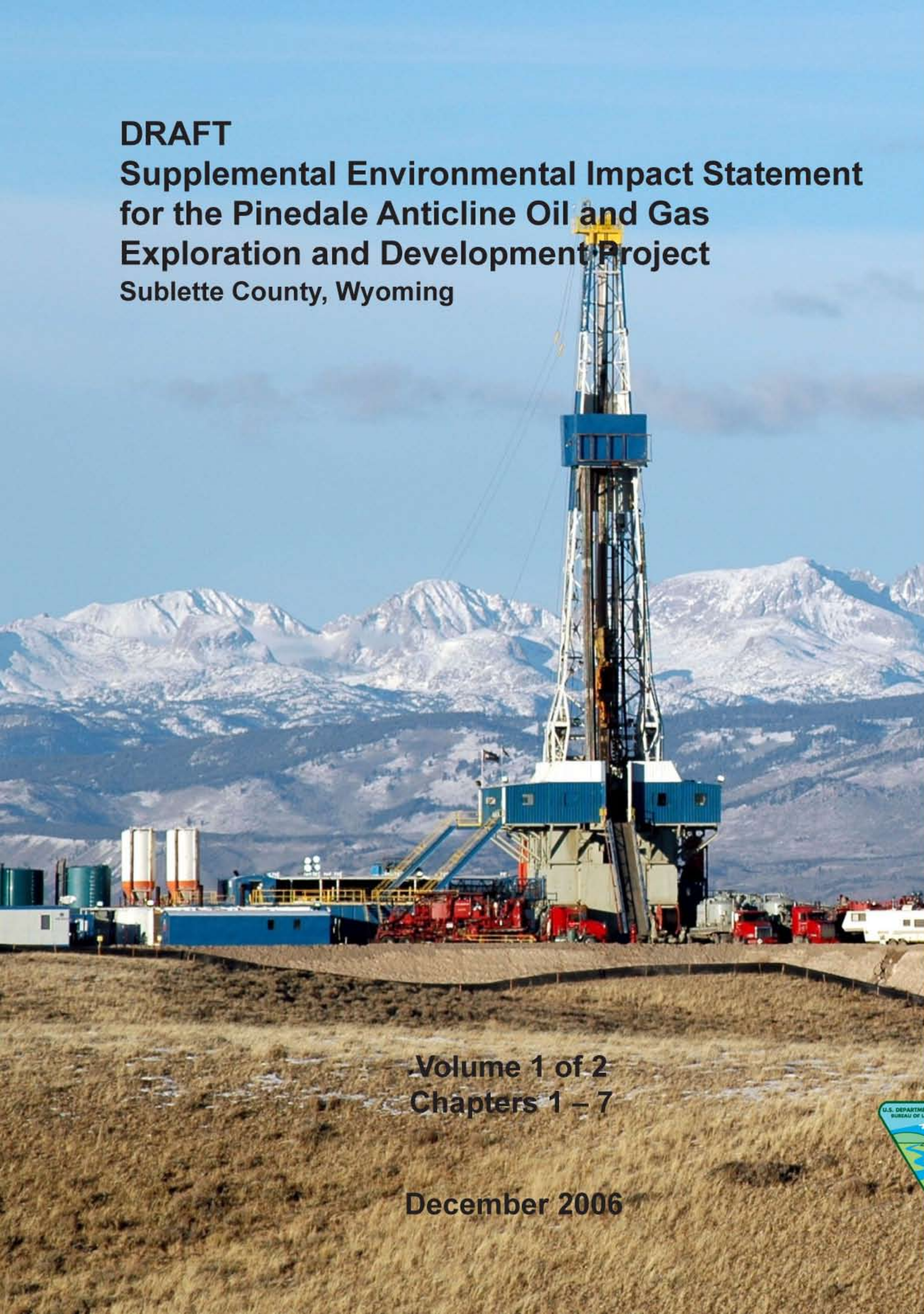
BLM

DRAFT
Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project
Sublette County, Wyoming



Pinedale Field Office

Volume 1 of 2
Chapters 1 – 7

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

December 2006

MISSION STATEMENT

It is the mission of the Bureau of Land Managment to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-07/001+1310

DRAFT
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
PINEDALE ANTICLINE OIL AND GAS EXPLORATION AND DEVELOPMENT PROJECT
SUBLETTE COUNTY, WYOMING

(Volume 1 of 2)

Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

Pinedale Field Office
Pinedale, Wyoming

In Cooperation with

State of Wyoming
Sublette County

December 2006

ABSTRACT

Draft Supplemental Environmental Impact Statement
Pinedale Anticline Oil and Gas Exploration and Development Project
Sublette County, Wyoming

Lead Agency: Bureau of Land Management, Pinedale Field Office, Pinedale, Wyoming

Type of Action: Administrative

Jurisdiction: Within Sublette County

Abstract: The Bureau of Land Management has received a proposal for long-term development of the Pinedale Anticline Project Area (PAPA) including consolidated development with year-round drilling. The PAPA consists of 198,034 acres and is located in west-central Wyoming in Sublette County, near Pinedale, Wyoming. The Town of Pinedale is located approximately 80 highway miles south of Jackson and 100 miles north of Rock Springs. There are currently more than 450 producing wells in the PAPA on 348 well pads. The wells are expected to produce for approximately 40 years and the life of the project (i.e., the time from first well is drilled to the last well is plugged and abandoned, and habitat function restored) is estimated at 60 years.

This document supplements analysis and decisions reached by the BLM, as the lead agency, in cooperation with the U.S. Forest Service, U.S. Army Corps of Engineers, and the State of Wyoming, in the *Final Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming* and in the *Record of Decision for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming.*

Three alternatives were considered in detail. The No Action Alternative (Alternative A) is required by the National Environmental Policy Act (NEPA) as a baseline against which two other action alternatives, consisting of the Proposed Action (Alternative B) and Alternative C, are analyzed. These alternatives provide a variety of management choices to mitigate the effects of resource development.

The Proposed Action includes year-round drilling and completions within big game crucial winter habitats and would occur in three Concentrated Development Areas within a core area centered on the Anticline Crest. Alternative C, rather than only specifying certain areas of development where year-round drilling could occur, specifies areas where year-round drilling would not occur. These alternatives are fully described in Chapter 2 of the Draft Supplemental Environmental Impact Statement (SEIS). The various impacts that would be expected from implementing each of the alternatives are disclosed in Chapter 4.

Further information regarding this Draft SEIS can be obtained from the address below. Comments will be accepted for 60 days following the date that the Environmental Protection

Agency publishes the notice of filing of this Draft SEIS in the Federal Register. Comments should be sent to the following address:

Matt Anderson
Bureau of Land Management
432 E. Mill Street
P.O. Box 768
Pinedale, WY 82941
307-367-5300

EXECUTIVE SUMMARY

The Department of Interior, Bureau of Land Management (BLM) Pinedale Field Office has been notified by Ultra Resources, Inc., Shell Exploration & Production Company, Questar Market Resources including Wexpro Company, BP America Production Company, Stone Energy Corporation, Yates Petroleum Corporation, and others who agree to participate, collectively referred to as the Operators, that they propose a new long-term development plan that includes limited year-round drilling and completions of natural gas wells within their leases in the Pinedale Anticline Project Area (PAPA). The PAPA encompasses 198,034 acres and is located near Pinedale, Wyoming in Sublette County. BLM has identified the need for additional pipeline corridors to transport hydrocarbon products from the PAPA to gas processing plants in southwestern Wyoming. Jonah Gas Gathering Company and Rendezvous Gas Services propose gas sales pipelines that would be placed within the new corridors, and Questar Gas Management and Mountain Gas Resources are proposing an expansion of the Granger Gas Processing Plant in Sweetwater County.

Since 2000, BLM has managed oil and gas development in the PAPA under the terms and conditions stated in the Record of Decision for the *Final Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project Sublette County, Wyoming* (PAPA ROD). BLM prepared this Draft Supplemental Environmental Impact Statement (SEIS) because the Operators' proposed long-term development plan is substantially different from the approach that was approved in the PAPA ROD. The Operators' proposal requests exemption from BLM stipulations for wildlife, which restrict their development activities within seasonal ranges. BLM has determined that the Operators' proposal could cause significant adverse impacts to the human and natural environments.

Regulations enacted by the Council on Environmental Quality state the conditions under which federal agencies should supplement existing documents (either draft or final environmental impact statements) that have been prepared to implement the National Environmental Policy Act - NEPA (40 CFR § 1502.9(c)(1)). The conditions include 1) substantial changes made by the agency that are relevant to environmental concerns; or 2) presence of significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. This Draft SEIS was prepared to assess the environmental consequences of the Operator's Proposed Action and alternative courses of action. It is intended to provide the public and decision makers with a complete and objective evaluation of impacts resulting from the Proposed Action and reasonable alternatives.

LIMITS BY THE PAPA ROD

Project components approved in Section 2 of the PAPA ROD include:

- 900 initial well pad locations on all lands and minerals within the PAPA;
- 700 producing wells and/or well pads on all lands and minerals within the PAPA;
- 700 production facilities at individual well locations;
- central production facilities;
- 4 compressor facility sites;
- water wells for drilling/completion;
- 1 BP Amoco Field Office;
- ~121.5 miles of sales pipeline corridor for multiple pipelines;
- ~276.0 miles of access road (including collector, local and resource roads); and
- ~280.0 miles of gathering pipeline system.

It was not the intent of the PAPA ROD to limit wells but rather to limit well pads within defined Management Areas (MAs) that were developed to conserve sensitive resources. The PAPA ROD specifies that if any of the authorized limits to development are reached, additional environmental analysis would be required.

EXISTING DEVELOPMENT

Since 2000, most natural gas development in the PAPA has been along the Anticline Crest, which is approximately 2 to 3 miles wide centered along the length of the PAPA. As of December 31, 2005, there were approximately 457 producing wells on 322 well pads in the PAPA. Of these, 428 wells on 266 well pads were drilled after issuance of the PAPA ROD. An additional 205 wells on 26 pads are projected for 2006. There were 33 drilling rigs operating during August 2005 in the PAPA, the most during any month since the PAPA ROD was issued. Twenty-three rigs were operating in December 2005. The threshold for total well pads in the PAPA ROD will not be reached by the end of 2006.

Approximately 176.5 miles of local and resource roads have been constructed and/or improved since the PAPA ROD was issued and the Operators are projecting an additional 5.9 miles of roads in 2006. At the end of 2006 there will be approximately 182.4 miles of roads in the PAPA that are subject to the 276.0-mile limit in the PAPA ROD. The threshold for roads in the PAPA ROD will not be reached by the end of 2006. Approximately 134.2 miles of gathering pipeline have been constructed between July 2000 and December 2005, with an additional 7.9 miles of gas gathering pipeline projected in 2006. The total of 142.1 miles of gathering pipeline is below the limit allowed by the PAPA ROD.

The PAPA ROD allowed for four compressor facility sites (three have been constructed) with varying levels of compression. The current level is within the amount of compression authorized in the PAPA ROD. The total nitrogen oxide (NO_x) emissions (472.2 tons/year) for compression are over the NO_x analysis threshold (376.59 tons/year) specified in the PAPA ROD. Total NO_x emissions for all emission sources are over the analysis threshold specified in the PAPA ROD (693.50 tons/year).

Since the PAPA ROD was issued, BLM has permitted other wellfield facilities that were not authorized in the PAPA ROD (stabilizer facility, central delivery points, water handling facility) through granting rights-of-way and/or additional NEPA analyses.

SCOPING

Public and agency scoping was conducted to determine issues relative to the Proposed Action. A scoping notice was mailed to potentially interested parties on October 21, 2005. All issues and concerns identified during scoping were evaluated to identify concerns that formed the basis for development of alternatives and the impact analyses. The nine key issues and concerns identified were: pace of development; conservation of wildlife; need for wildlife mitigation; wildlife displaced to private land; increased winter traffic; economic stability in Sublette County; industrialization and single use of land; declining wildlife populations; effects to surface water and groundwater; and effects to air quality in the region. The three alternatives meet the Purpose and Need of the proposal but vary in response to the concerns. Other alternatives were considered but were not analyzed in detail for a variety of reasons.

ALTERNATIVES

Alternative A - No Action Alternative

The No Action Alternative is based on elements authorized by the PAPA ROD. Development in the PAPA beyond the levels specified in the PAPA ROD would require additional environmental review; however, the thresholds have not been reached for wellfield components. The PAPA ROD did not specify the type or extent of the additional environmental review that would be required.

The No Action Alternative is required by the National Environmental Policy Act (NEPA) as a baseline against which other action alternatives can be analyzed. For this project, the No Action Alternative is a continuation of current BLM management practices. Wellfield development could continue on state and private leases and would occur on federal leases as authorized by prior NEPA decisions.

Alternative B - Proposed Action Alternative

The Proposed Action includes year-round drilling, completions, and production of up to 4,399 additional wells on up to 12,278 acres of new disturbance, including well pads, roads, pipelines, and other ancillary facilities within the PAPA. Drilling and completions within big game crucial winter habitats would occur in each of three Concentrated Development Areas within a core area centered on the Anticline Crest. The Operators propose to install a liquids gathering system in the central and southern portions of the PAPA complimenting the existing liquids gathering system in the northern portion of the PAPA. Tier 2 equivalent emission controls would be installed on drilling rig engines in 29 out of 48 drilling rigs at peak drilling in 2009. The Operators have offered 3:1 offsite mitigation for wildlife, if necessary.

Alternative C

Alternative C is similar to the Proposed Action Alternative in that it consists of the same project components including up to 4,399 additional wells on up to 12,278 acres of disturbance, however, it is spatially different. That is, rather than only specifying certain areas of development where year-round drilling could occur, Alternative C specifies areas where year-round drilling would not occur. It includes a core area boundary that is smaller than the Proposed Action core area. The overall objective of Alternative C is to control spatial disturbance over time maximizing development in some areas while minimizing development in other areas, especially in portions of big game crucial winter ranges. Alternative C includes five development areas. There would be temporary relaxation of seasonal wildlife stipulations in two of the three development areas coinciding with big game crucial winter ranges at any time. Additional mitigation, developed by BLM as Performance Based Objectives is included in Alternative C as well as measures to further reduce air quality impacts beyond that included in the Proposed Action Alternative.

ENVIRONMENTAL IMPACTS

Socioeconomics

Beneficial direct impacts to socioeconomics by all alternatives include increased employment, particularly for local residents. However, locally hired workers exert pressure on limited local housing markets. Increased populations are expected in Lincoln, Sublette, and Sweetwater counties which will negatively impact demand for local infrastructure, services, and facilities. Direct, indirect, and induced economic benefits to Sublette County from continuation of wellfield development in the PAPA would be substantial.

Transportation

Each alternative would require construction of additional roads to support increased wellfield traffic. Traffic levels would increase during winter with year-round drilling. Increased traffic would increase road maintenance costs and could lead to increased vehicular accident rates.

Land Use and Residential Areas

Continued development and surface disturbance in the PAPA by any of the alternatives will change some existing land use categories to a predominant industrial landscape. In particular, additional surface disturbance would be in conflict with the goals of Sublette County Resource Conservation Zoning District. No new wellfield development is expected to conflict with any Sublette County residential zoning districts but there will be new disturbances within the Residential SRMZ.

Recreation

Decreased recreational use of OHV areas in the PAPA, by additional surface disturbance, is expected for each alternative. Decreased hunting opportunities are expected in the PAPA with decreased abundance of big game and upland game birds as density of wellfield development increases.

Visual Resources

Wellfield development has and will continue to be the locally dominant feature in VRM Class II under each alternative. Similarly, wellfield development is and will continue to be a dominant feature in VRM Class III. All alternatives are expected to lead to local industrialized appearances in the Sensitive Viewshed SRMZ.

Cultural and Historic Resources

Destruction and/or unexpected discoveries of archaeological resources are expected consequences of new surface disturbance in the PAPA by each alternative. Increased disturbance is likely in areas with high potential for major finds (sandy bluffs north of the New Fork River, not in Mesa Breaks). Potential surface disturbance in the 0.25-mile buffer of the Lander Trail may decrease the visual integrity within the Lander Trail SRMZ.

Air Quality

It is expected that there would be no violations to applicable federal and state air quality standards. Air quality impacts to visibility at regional Class I airsheds (e.g., Bridger Wilderness Area) are anticipated under all alternatives. A detailed analysis of air quality effects is provided in the *Air Quality Impact Analysis Technical Support Document*.

Noise

Drilling and completion under each alternative would increase noise above 10 dBA at noise-sensitive sites (residences, greater sage-grouse leks) up to 2,800 feet away.

Geology and Geologic Hazards

Additional disturbance by each alternative would increase erosion and slope instability by disturbance to soils on slopes ≥ 15% with high erosion potential. Continued drilling would lead to eventual depletion of the natural gas resource.

Paleontological Resources

Additional surface disturbance by each alternative would increase the possibility of loss, damage, or destruction of fossils in the Blue Rim Area.

Groundwater

Drilling of water supply wells under each alternative could lead to temporary drawdown of the Wasatch aquifer. Water use from supply wells within the PAPA is expected to decrease under all alternatives as produced water is re-used to a greater degree.

Surface Water

Annual sediment yields would be increased substantially above current conditions in six hydrologic sub-watersheds that coincide with the Anticline Crest. Surface water quality could be impacted under all alternatives if BMPs are not used extensively to prevent erosion and reclamation is not timely.

Soil Resources

Each alternative would disturb sensitive soils with high erosion potential and low revegetation capabilities. Disturbances to soils on slopes ≥ 15% with high erosion potential are expected to increase soil erosion and sedimentation in aquatic habitats substantially above current conditions under all alternatives.

Vegetation Resources

Removal of existing native vegetation would be considerable under all of the alternatives. Surface disturbance in native vegetation dominated by shrubs and trees would be converted to herbaceous vegetation. Unsuccessful revegetation with increased presence of noxious weeds (Canada thistle, perennial pepperweed) is expected on unreclaimed bare ground.

Grazing Resources

Loss of livestock grazing capacity (AUMs) by removal of existing native vegetation in the PAPA is expected within some grazing allotments. Decreased grazing capacity with increased presence of noxious weeds (Canada thistle, perennial pepperweed) is likely on unreclaimed bare ground.

Wetlands, Riparian Resources and Flood Plains

Loss of wetlands and/or wetland function due to surface disturbance in wetlands is likely under each alternative. Surface disturbance in the wetland SRMZ with increased sedimentation in aquatic habitats is possible with removal of forest-dominated riparian and shrub vegetation. Surface disturbance within the 100-year flood plain may adversely affect flood plain function which includes river channel migration.

Threatened, Endangered Species and Special Status Species

Nesting bald eagles may be affected by surface disturbance and associated human presence by each alternative. The effects are expected to be substantial within 1 mile of the New Fork River riparian zone with potential effects to forested-dominated riparian habitat which is utilized by wintering bald eagles.

Effects to endangered Colorado River fish species are not anticipated. Even though there will be short-term surface water withdrawals and groundwater withdrawals, there may be a net contribution to the Colorado River Basin as a result of the produced water discharge from the Anticline Disposal Facility.

Direct effects to special status wildlife species that depend on upland habitats (sagebrush steppe, mixed grass prairie, greasewood and desert shrub), forest-dominated riparian forest habitats, and wetland habitats are expected under each alternative. Special status fish species may be adversely affected by increased sedimentation in aquatic habitats. Direct effects to extant populations of special status plant species are possible with surface disturbance in the Blue Rim Area under each alternative.

Wildlife and Aquatic Resources

Implementation of any alternative is likely to create additional barriers to wildlife movements with increased fragmentation by creation of edges and patches within former contiguous habitats. There would be indirect effects to species that depend on upland habitats (sagebrush steppe, mixed grass prairie, greasewood and desert shrub), forest-dominated riparian habitats, and wetland habitats. Big game would continue to be adversely affected by wellfield development that causes direct loss of crucial winter range, other seasonally-used habitats, and decreased habitat function near roads and well pads due to human activity. Similarly, decreased habitat function is expected at greater sage-grouse leks by surface disturbance and potential human presence within 0.25 mile of leks during breeding and within 2 miles of nesting and brood-rearing habitats. Fragmentation and direct loss of native habitats by surface disturbance is expected to adversely affect migratory birds, particularly in habitats used by sagebrush-obligate species. Decreased raptor nesting habitat effectiveness is likely within 1 mile of New Fork River riparian zone. Decreased reproductive success in spring-spawning native salmonid species is possible from increased sedimentation in aquatic habitats and loss of forest-dominated riparian and shrub vegetation by each alternative.

MITIGATION MEASURES

Mitigation measures could be applied during all phases of the project to minimize potential impacts to all resources. The Gold Book - *Surface Operating Standards and Guidelines for Oil and Gas Gold Book* promotes the use of Best Management Practices and Standards to reduce impacts and would apply to all alternatives. Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b). Under the Proposed Action, Operators have proposed additional mitigation to further reduce impacts (Appendix C). BLM has developed Performance Based Objectives that would apply to Alternative C (Appendix E).

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Abbreviations and Acronyms

AEM	adaptive environmental management
AQTSD	Air Quality Technical Support Document
ANC	acid neutralizing capacity
AO	Authorized Officer
APD	Application for Permit to Drill
AQD	Air Quality Division
AQRV	air quality related value
ARPA	Archeological Resources Protection Act
ASU	Anschutz, Shell and Ultra
AUM	animal unit month
BART	best available retrofit technology
bbl	barrel
BCC	Bird Canyon Corridor
BBS	Breeding Bird Survey
BFGC	Blacks Fork Granger Corridor
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BMP	best management practices
BP	before present
BTEX	benzene, toluene, ethylbenzene and xylene
BTNF	Bridger-Teton National Forest
CAPS	Cooperative Agricultural Pest Survey
CASTNET	Clean Air Status and Trends Network
CDA	concentrated development area
CDP	central delivery point
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFS	cubic feet per second
CGF	central gathering facility
CIAA	cumulative impact assessment area
CO	carbon monoxide
COE	U.S. Army Corps of Engineers
C/OSPF	central off site production facility
CPF	centralized production facilities
CSD	consolidated school district
CX	categorical exclusions
DA	development areas
DATS	depositional analysis thresholds
dBA	decibel on the A-weighted scale
DOI	Department of the Interior
dv	deciview
DNA	Determination of NEPA Adequacy
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEIS	final environmental impact statement
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FMR	federal mineral royalties
FONSI	Finding of No Significant Impact
FWS	U.S. Fish and Wildlife Service
g/hp-hr	grams per horsepower hour

gpm	gallons per minute
GTNP	Grand Teton National Park
HAPs	hazardous air pollutants
HDD	horizontal directional drilling
HMA	herd management area
hp	horsepower
HU	herd unit
HUC	hydrologic unit code
IDLH	immediately dangerous to life or health
ID Team	BLM Interdisciplinary Team
IMPROVE	Interagency Monitoring of Protected Visual Environments
ISD	independent school district
JGGC	Jonah Gas Gathering Company
JIDPA	Jonah Infill Drilling Project Area
KINIEROS2	Kinematic Runoff and Erosion Model-Version 2
kg/ha-yr	kilograms per hectare year
KOP	key observation point
lb/acre/yr	pounds per acre per year
LAC	level of acceptable change
LOC	level of concern
LOP	life of project
MA	management area
MCF	thousand cubic feet
mg/L	milligrams per liter
MGR	Mountain Gas Resources
MLE	most likely exposure
MMCF	million cubic feet
MMSCF/D	million standard cubic feet per day
MOU	memorandum of understanding
mph	miles per hour
MSCF	thousand standard cubic feet
NAAQS	National Ambient Air Quality Standards
NADP	National Acid Deposition Program
NAICS	North American Industry Classification System
ND	non-disclosure
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NO_x	nitrogen oxide
NO_2	nitrogen dioxide
NOI	Notice of Intent
NPS	National Parks Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSO	no surface occupancy
NTN	National Trends Network
NWS	National Weather Service
O_3	ozone
OHV	off-highway vehicle
OMB	Office of Management and Budget
OPC	OpalPioneer Corridor
PA	Programmatic Agreement
PAPA	Pinedale Anticline Project Area
PAWSA	Pinedale Anticline Wildlife Study Area
PAWG	Pinedale Anticline Working Group
PBC	Paradise Bird Canyon

PCB	polychlorinated biphenol
PFO	Pinedale Field Office
PFYC	Probable Fossil Yield Classification
PILT	Payment In Lieu of Taxes
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
PRBP	Powder River Basin Project
PSD	Prevention of Significant Deterioration
PVFD	Pinedale Volunteer Fire Department
QGM	Questar Gas Management
Questar	Questar Market Resources
R6	Rendezvous Phase 6
RELs	reference exposure levels
RFCs	reference concentrations for chronic inhalations
RFD	reasonably foreseeable development
RFFA	reasonably foreseeable future actions
RGS	Rendezvous Gas Services
RMIS	Recreation Management Information System
RMG	Resource Management Group
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RP	resource protection
RPO	Regional Planning Organization
SCCD	Sublette County Conservation District
SEIS	supplemental environmental impact statement
SEO	State Engineer's Office
Shell	Shell Exploration & Production Company
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SPCC	Spill Prevention, Containment and Countermeasures
SRMA	Special Recreation Management Area
SRMZ	Sensitive Resource Management Zone
SUGMA	Small and Upland Game Management Area
SUV	sport utility vehicle
SVR	standard visual range
SWAT	Soil and Water Assessment Tool
SWPPP	Stormwater Pollution and Prevention Plan
TCPs	traditional cultural properties
TDS	total dissolved solids
tpy	tons per year
TSS	total suspended solids
*u*eq/l	microequivalents per liter
ug/m^3	micrograms per cubic meter
Ultra	Ultra Resources Inc.
URF	unit risk factor
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VRM	visual resource management
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WOGCC	Wyoming Oil and Gas Conservation Commission

WSII	Wyoming Stream Invertebrate Index
WYDOT	Wyoming Department of Transportation
YNP	Yellowstone National Park

Chapter 1
Introduction

1.1 INTRODUCTION

As lead agency, the U.S. Department of Interior (DOI), Bureau of Land Management (BLM), has prepared this Draft Supplemental Environmental Impact Statement (SEIS) to evaluate and disclose to the public the direct, indirect, and cumulative environmental impacts associated with a proposed long-term plan for continued exploration and development of natural gas resources in the Pinedale Anticline Project Area (PAPA) in Sublette County, Wyoming (see Map 1.1-1). BLM is the lead agency for this Draft SEIS because they have regulatory responsibility for all federally owned mineral leases, which are approximately 80 percent of the 309-square mile PAPA. The State of Wyoming and Sublette County are participating in the preparation of this Draft SEIS as cooperating agencies.

Jointly referred to as the Operators, Ultra Resources, Inc. (Ultra), Shell Exploration & Production Company (Shell), Questar Market Resources including Wexpro Company (Questar), BP America Production Company, Stone Energy Corporation, Yates Petroleum Corporation, and others who agree to participate, have notified the BLM Pinedale Field Office (PFO) that they propose a new long-term development plan that includes limited year-round drilling and completions of natural gas wells within their leases in the PAPA (see Map 1.1-2). BLM has identified the need for additional pipeline corridors to transport hydrocarbon products from the PAPA to gas processing plants in southwestern Wyoming. Jonah Gas Gathering Company (JGGC) and Rendezvous Gas Services (RGS) propose gas sales pipelines that would be placed within the new corridors, and Questar Gas Management (QGM) is proposing an expansion of the Granger Gas Processing Plant in Sweetwater County. Analysis of potential impacts associated with the corridors, gas sales pipelines, and the Granger Plant is included in this document.

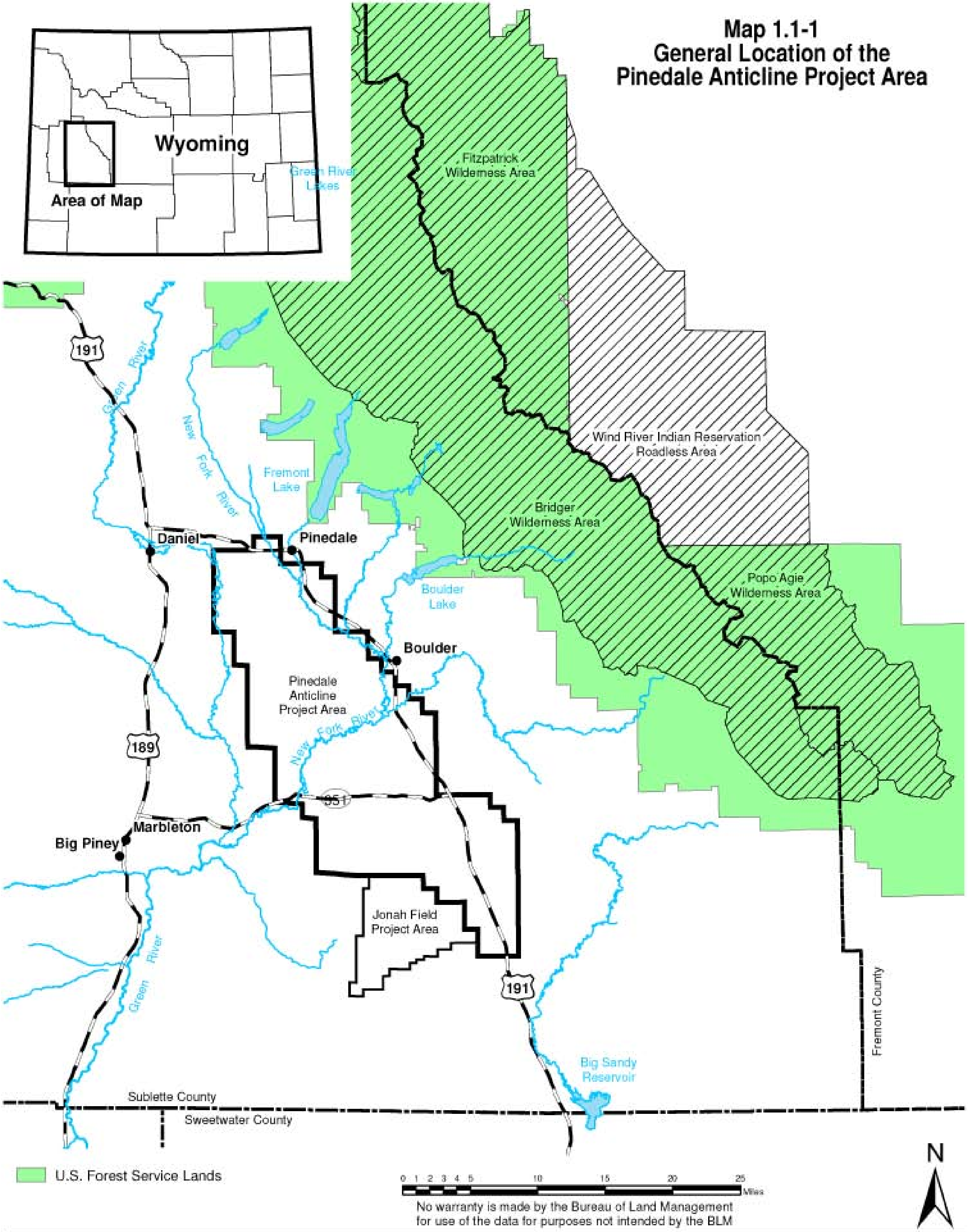
This document supplements analysis and decisions reached by the BLM as the lead agency, in cooperation with the U.S. Department of Agriculture Forest Service (USFS), U.S. Army Corps of Engineers (COE), and the State of Wyoming, in the *Final Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming* (the PAPA FEIS - BLM, 2000a) and in the *Record of Decision for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming* (the PAPA ROD - BLM, 2000b).

Regulations enacted by the Council on Environmental Quality (CEQ, 1978) require federal agencies to prepare supplements to existing documents (40 CFR § 1502.9(c)(1)) implementing provisions of the National Environmental Policy Act (NEPA) if:

"*(i) The agency makes substantial changes that are relevant to environmental concerns; or*
(ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts."

BLM provided similar guidance in Handbook H-1790-1 (BLM, 1988a) with the additional explanation:

"if an existing relevant environmental document does not fully cover a proposed action and it is not appropriate to tier, then a determination should be made on whether to supplement or modify the existing document or prepare an entirely new one."


Map 1.1-1
General Location of the
Pinedale Anticline Project Area
Wyoming
Area of Map
Green River Lakes
Fitzpatrick Wilderness Area
Wind River Indian Reservation Roadless Area
Bridger Wilderness Area
Popo Agie Wilderness Area
Fremont Lake
Boulder Lake
Green River
New Fork River
Daniel
Pinedale
Boulder
Pinedale Anticline Project Area
Jonah Field Project Area
Marbleton
Big Piney
191
189
351
Big Sandy Reservoir
Sublette County
Sweetwater County
Fremont County
U.S. Forest Service Lands
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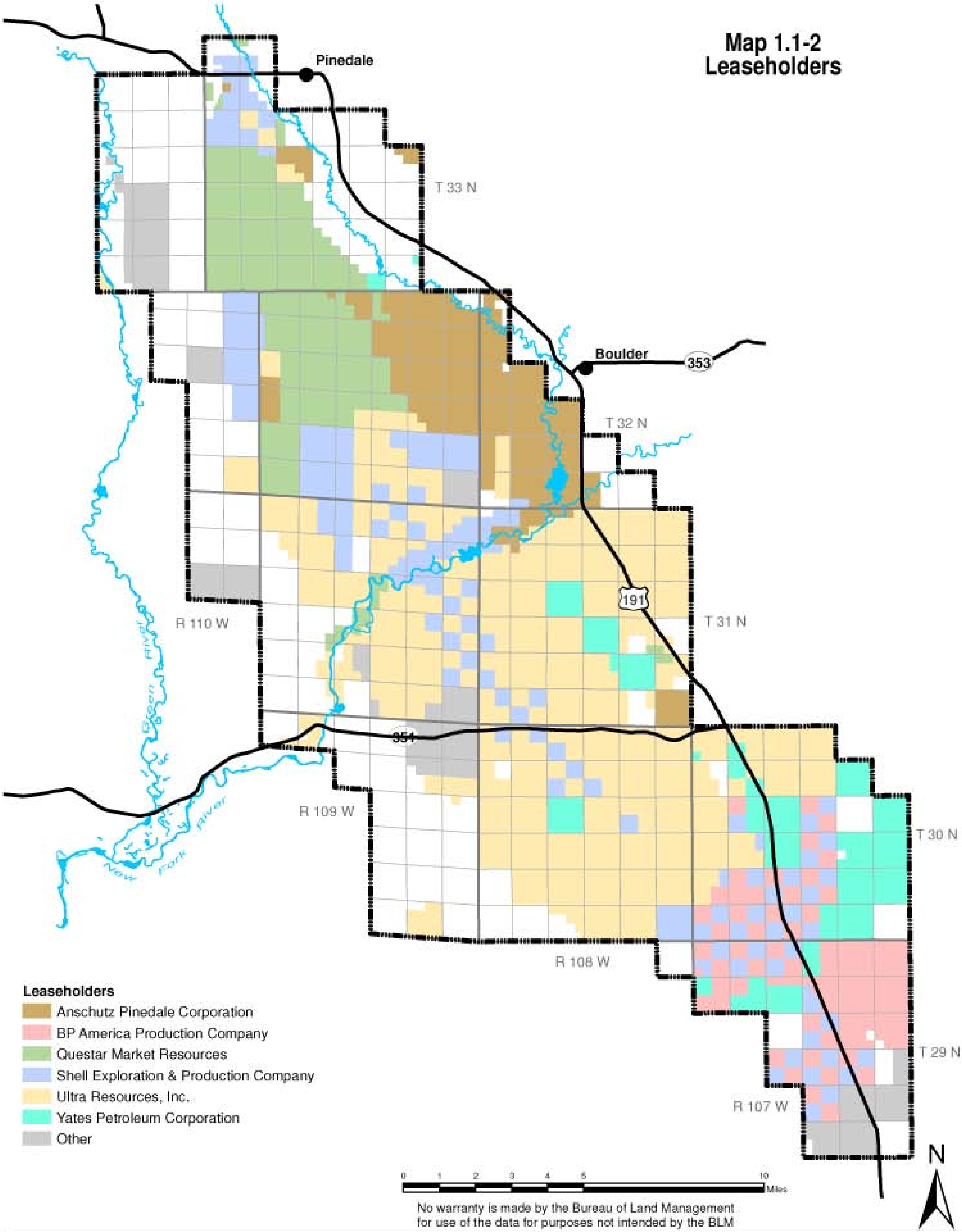
Map 1.1-2
Leaseholders
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Leaseholders
Anschutz Pinedale Corporation
BP America Production Company
Questar Market Resources
Shell Exploration & Production Company
Ultra Resources, Inc.
Yates Petroleum Corporation
Other
0
1
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4
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10
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No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
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BLM prepared this Draft SEIS because the Operators' proposed long-term development plan is substantially different from the approach that was analyzed in the *Draft Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project – Sublette County, Wyoming* (the PAPA DEIS - BLM, 1999a) and approved in the PAPA ROD (BLM, 2000b). Limits on levels of development and analysis thresholds were set forth in the PAPA ROD. Under the current proposal, these limits may be exceeded. Analysis thresholds associated with air quality have already been exceeded. The Operators' proposal requests exemption from BLM stipulations for wildlife, which restrict development activities within seasonal ranges. BLM has determined the Operators' proposal could cause significant adverse impacts to the human and natural environments.

BLM has recognized that additional air quality impact analysis is required for continued development of the PAPA. The PAPA ROD (BLM, 2000b) states:

> *"If activity and corresponding emission assumptions and/or impacts exceed those identified in the Pinedale Anticline EIS (376.59 tons/year of NO_x emission from compressors or 693.50 tons/year NO_x emissions from the combination of construction/drilling, well production, and compression), the BLM, in cooperation and consultation with Wyoming Department of Environmental Quality-Air Quality Division (DEQ-AQD), EPA Region VIII, USDA-Forest Service, and other affected agencies, will undertake additional cumulative air quality environmental review as required by CEQ regulations 40 CFR 1502.9(c)(1)(ii)."*

BLM has determined the nitrogen oxide (NO_x) emissions from all sources in the PAPA currently exceed the 693.50 tons per year (tpy) analysis threshold specified in the PAPA ROD (BLM, 2000b). This Draft SEIS serves as the additional cumulative air quality environmental review referenced above.

1.2 REGIONAL SETTING

The PAPA is located in west-central Wyoming in Sublette County (see Map 1.1-1). The Town of Pinedale is situated on the northern end of the PAPA. Pinedale is located approximately 80 highway miles south of Jackson and 100 miles north of Rock Springs. Other communities/settlements in the general vicinity of the PAPA include Cora, Daniel, Boulder, Bargerville, Marbleton, and Big Piney.

The PAPA lies between U.S. Highway 191 and the Green River. U.S. Highway 191 runs along the eastern and northern edges of the PAPA and is the primary route to the PAPA as well as the primary route for tourist travel to Yellowstone and Grand Teton National Parks. U.S. Highway 189, also a primary tourist travel route, runs west of the PAPA, and State Highway 351 crosses through the southern portion of the PAPA (see Map 1.1-1). No national forest lands are located in the PAPA; however, the Bridger-Teton National Forest is located west, north, and east of the PAPA. The northern boundary of the PAPA comes within 2.3 miles of these national forest lands.

Sagebrush dominates the PAPA with desert vegetation blending into riparian areas and wetlands of the New Fork River and Green River flood plains. The higher elevation area between these rivers in the northern half of the PAPA is known locally as the Mesa.

1.3 PAPA EIS AND ROD

In the PAPA ROD (BLM, 2000b), BLM's Preferred Alternative is the *Resource Protection Alternative on Federal Lands and Minerals,* as modified from the PAPA DEIS (BLM, 1999a). It is important to summarize the level of natural gas development approved by the BLM in the PAPA ROD because this document supplements the information and analyses in the PAPA DEIS. Collectively, the DEIS and the FEIS are the PAPA EIS.

If any one word could characterize the PAPA EIS, it would be "*uncertainty*" (e.g., see PAPA DEIS, page 1-2). Potential development evaluated in the PAPA EIS was a maximum of 900 initial well pads and 700 producing well pads over 10 to 15 years, which some participants considered optimistic (PAPA DEIS, page 2-2). BLM asserted, "*it is possible that development within the PAPA could go beyond the levels of development considered in this EIS, although few would consider such a level of development as reasonably foreseeable*" (PAPA DEIS, page 2-2).

To allow implementation of the Preferred Alternative, BLM required a supplemental environmental analysis if any approved levels of development in the PAPA ROD (BLM, 2000b) were exceeded. Project components approved in Section 2 of the PAPA ROD include:

- 900 initial well pad locations on all lands and minerals within the PAPA,
- 700 producing wells and/or well pads on all lands and minerals within the PAPA,
- 700 production facilities at individual well locations,
- central production facilities,
- 4 compressor facility sites,
- water wells for drilling/completion,
- 1 BP Amoco Field Office,
- ~121.5 miles of sales pipeline corridor for multiple pipelines,
- ~276.0 miles of access road (including collector, local, and resource roads), and
- ~280.0 miles of gathering pipeline system.

Section 2 also states, "*This ROD authorizes the construction and drilling of up to 900 wells and the completion, testing, and production of up to 700 producing natural gas well pads within the PAPA*".

In addition to expressing "*uncertainty*", the PAPA ROD is ambiguous. In Section 2 alone, it is evident that, from the bulleted list and the statement above, it is not clear whether the PAPA ROD is authorizing "700 wells" or "700 producing well pads", and "900 well pad locations" or "900 wells". Furthermore, in Section 1 - Introduction of the PAPA ROD the following statements occur:

- "*BLM approves the Pinedale Anticline Operators proposal for 700 producing well pads*",
- "*The ROD recognized that in order to develop 700 productive well pads in the PAPA, as many as 900 well pads may need to be constructed", and*
- "*Monitoring for project consistency with the scope of EIS analysis will be based on the total of 700 producing well pads.*"

When the PAPA ROD (BLM, 2000b) was issued in July 2000, the extent to which directional drilling would be implemented in the PAPA was uncertain. There was allowance in the PAPA ROD for multi-well pads, although it was generally assumed at the time that most well pads would contain a single well. It was not the intent of the PAPA ROD to limit wells but rather to limit well pads within defined Management Areas (MAs) based on sensitive resources. The air quality impact assessment for the PAPA EIS assumed that there would be 700 producing wells in the PAPA. Hence, the ambiguous interchange between wells and well pads.

Multiple requirements for managing development related impacts to specific resources are defined in Section 3 and various appendices to the PAPA ROD (BLM, 2000b). These requirements are summarized in Table 1 of Appendix A herein as:

- Requirements of federal statute and/or agency policy;
- Required plan for development or for implementing another action;
- Required multi-party memorandum of understanding (MOU), programmatic agreement (PA), or less formal agreement;
- Required Adaptive Environmental Management (AEM) with monitoring and/or reporting;
- Required implementation of relevant practices and guidelines; and
- Implementation of required or suggested mitigation.

BLM's Preferred Alternative was to be implemented with restrictions to exploration and development within each of nine defined MAs. Some of the MAs represent various combinations of sensitive resource management zones (SRMZs) analyzed in the PAPA EIS. While the extent of development within the entire PAPA was limited by BLM's Approved Project Components (BLM, 2000b - Section 2) and Administrative Requirements and Conditions of Approval (BLM, 2000b - Section 3), Section 4 of the PAPA ROD (BLM, 2000b) provided specific limits of development within each of the nine MAs based on numbers of producing well pads.

In each MA, the average and maximum number of producing well pads per square mile were based on analysis of various assumptions and limits in the PAPA EIS. According to the PAPA ROD, should development in a MA reach the threshold number of producing well pads, BLM approval of additional pads would halt until additional environmental analyses were completed or until wells on a pad were no longer producing gas, had been plugged, and the pad area had been reclaimed for one full growing season. In such cases, the reclaimed pad would be credited back to the MA and a new well pad may be developed as long as the approved threshold is not exceeded. Descriptions of each MA, objectives for managing the MA, and allowable levels of development are summarized in Table 2 of Appendix A of this document.

Uncertainties associated with levels of exploration and development and geographic distribution of development in each MA are reflected in the allowable levels of development in Table 2 (Appendix A, herein). To ensure specific MA objectives were being met, BLM required a comprehensive monitoring program using an AEM process requiring participation by cooperating agencies and the public. CEQ requires monitoring as a component of NEPA (1978 – 40 CFR §1505.2(c) and §1505.3). The AEM process was implemented in August 2004, when the Secretary of Interior officially chartered the Pinedale Anticline Working Group (PAWG) and task groups to develop recommendations and provide advice to the BLM on monitoring and mitigation issues related to natural gas development in the PAPA.

1.4 EXCEPTIONS AND SUBSEQUENT NEPA DOCUMENTS TIERED TO THE PAPA EIS

The PAPA ROD (BLM, 2000b) allows exceptions (Appendix A-6 in the PAPA ROD) to *Administrative Requirements and Conditions of Approval* (Section 3) for a variety of situations, including seasonal restrictions protecting wildlife and requirements made by BLM for an operator(s) to use Centralized Production Facilities (CPF), directional drilling, and/or pad drilling (multiple wells drilled from the same well pad). The BLM PFO Manager, or his/her designee as the Authorized Officer (AO), grants such exceptions. The Pinedale Resource Management Plan

(RMP - BLM, 1988b) and other NEPA documents authorize this exception process under the Wyoming BLM Standard Mitigation Guidelines for Surface-Disturbing Activities.

In addition to exceptions to lease stipulations, BLM (2003a) noted, *"waivers, exceptions, and modifications are viable and effective means of adapting oil and gas lease stipulations to meet changing circumstances. Circumstances for granting a waiver, exception, or modification are documented in most existing land use plans and are a requirement of all future land use plans*", and provided the following application of the terms:

- Lease stipulation waiver is a permanent exemption to a lease stipulation;
- Lease stipulation exception is a one-time exemption to a lease stipulation and exceptions are determined on a case-by-case basis; and
- Lease stipulation modification is a change to the provisions of a lease stipulation, either temporarily or for the term of the lease.

Since 2000, BLM PFO has considered exceptions to big game crucial winter range seasonal stipulations, raptor and/or greater sage-grouse breeding/nesting habitat, and raptor and/or greater sage-grouse winter concentration areas. Exceptions to these stipulations have been granted, partially granted, or denied for a variety of activities including drilling, completions, equipment removal, pipeline installation, surveying, seismic and geophysical surveys, wildlife research studies, and various other wellfield activities.

Prior to making decisions regarding exceptions, BLM coordinates a review with the Wyoming Game and Fish Department (WGFD). In the case of crucial big game winter range, a consultation is held with WGFD biologists to assess animal presence or absence, animal condition, weather severity, habitat condition and availability, specific site location, and requested action. Exception requests and subsequent decisions made by BLM from 2001 through 2005 are summarized in Table 3 of Appendix A in this document.

After the approval of the PAPA ROD (BLM, 2000b), BLM evaluated four requests for approval of development strategies related to year-round drilling in subsequent Environmental Assessments (EAs). The Decision Records for each of the EAs are included in Table 4 in Appendix A and are summarized below:

- <u>Questar Year-Round Drilling Proposal – EA Number WY-100-EA05-034, November 2004</u> - Questar proposed installation of a gathering system for condensate and produced water within the PAPA, a pipeline to transport crude petroleum from the PAPA, and to utilize Tier 2 equivalent emission controls on all drilling rig engines by 2007. In November 2004, BLM issued a Decision Record (BLM, 2004a) approving the proposal allowing Questar to utilize up to six drilling rigs (two rigs per pad for up to three pads between November 15 and April 30 for 9 years beginning November 15, 2005).

- <u>Questar Year-Round Drilling Proposal –Condensate Pipeline Modification (QYDP-CPM) EA Number WY-100-EA05-283, July 2005</u>. In July 2005, BLM issued a Decision Record (BLM, 2005a) for modification of the condensate (crude petroleum) pipeline route. Approval of drilling operations between November 15, 2005 and April 30, 2006 would be contingent upon the liquids gathering system being operational by November 15, 2005. The Decision Record required Questar to utilize Tier 2 equivalent emission controls on year-round drilling rig engines by January 1, 2008.

- ASU Year-Round Drilling Demonstration Project - EA Number WY-100-EA05-254, September 2005. Anschutz, Shell and Ultra submitted a proposal to BLM for a year-round demonstration project. In September 2005, BLM issued a Decision Record (BLM, 2005b) that approved drilling operations between November 15, 2005 and July 31, 2006 within big game crucial winter ranges. It allowed completion operations beginning May 1, 2006. The Decision Record allowed up to two drilling rigs on each of three well pads between November 15, 2005 and July 31, 2006.

- Questar Year-Round Drilling Proposal, Addendum - EA Number WY-100-EA06-043, November 2005. BLM issued a Decision Record (BLM, 2005c) that allowed for accelerated winter development on the Mesa, including well completions and the addition of a third drilling rig.

1.5 EXISTING DEVELOPMENT IN THE PAPA

Since 2000, most natural gas development in the PAPA has been along the Anticline Crest, which is approximately 2 to 3 miles wide centered along the length of the PAPA. The Operators are proposing long-term development within the Anticline Crest as well as continued exploration off the Anticline Crest. As of December 31, 2005, there were approximately 457 producing wells on 322 well pads in the PAPA. Of these, 428 producing wells on 266 well pads were drilled after issuance of the PAPA ROD (BLM, 2000b). An additional 205 producing wells on 26 well pads are projected for 2006. There were 33 drilling rigs operating during August 2005 in the PAPA, the most during any month since the PAPA ROD was issued. Twenty-three rigs were operating in December 2005.

1.6 PROPOSED ACTION

The Operators have proposed a long-term plan for continued development of the PAPA. Their proposal includes up to 4,399 new producing wells that would be drilled from 250 new well pads and from expansion of existing well pads. The Operators are requesting temporary relaxation of seasonal wildlife stipulations in big game crucial winter range and in sage grouse seasonal habitats. The Operators have defined a “core area” within which they propose several Concentrated Development Areas (CDAs). They propose to drill and complete wells during winter (November 15 through April 30) within the CDA portions that coincide with big game crucial winter habitats.

It is estimated that surface disturbance would continue through 2023 and would consist of 12,278 acres of initial disturbance with a life-of-project (LOP) disturbance of 4,093 acres. This disturbance would be in addition to the current existing wellfield disturbance in the PAPA of 5,049 acres. Project components consist of new well pads, expansion of existing well pads, production equipment, gas gathering pipelines, access roads and other ancillary facilities. The Operators are proposing to install additional liquids gathering systems resulting in most of the producing wells being connected to a liquids gathering system. This would result in a reduction of truck traffic that is currently required to haul the condensate and produced water. The Operators are proposing to implement Tier 2 equivalent emission controls on 60 percent of the drilling rig engines operating in the PAPA by 2009, thereby reducing impacts to air quality and air quality related values (AQRVs) in nearby wilderness areas. Two gas sales pipelines are proposed that would transport natural gas from the PAPA to gas processing plants in southwestern Wyoming. BLM has identified three new pipeline corridors that would contain the gas sales pipelines. An expansion of the Granger Gas Plant is also proposed.

1.7 PURPOSE AND NEED

The purpose and need of this document is to supplement the existing PAPA DEIS (BLM, 1999a) through analysis and evaluation of the potential impacts of the approval of additional natural gas development in the PAPA. This Draft SEIS is necessary because there are substantial changes in the Proposed Action that are relevant to environmental concerns ((40 CFR 1502.9(c)(1)(i)) or there are significant new circumstances or facts relevant to environmental concerns and bearing on the Proposed Action or its impacts that were not addressed in the existing analysis (40 CFR 1502.9(c)(1)(ii)). This document discloses and analyzes impacts associated with the No Action Alternative, the Proposed Action Alternative, and a third alternative (Alternative C) in an effort to determine the direction of development within the PAPA. The ROD resulting from this supplemental analysis will consider BLM's greater knowledge and understanding of the natural gas resource in the PAPA since the PAPA ROD (BLM, 2000b) was issued. The decision will include development of appropriate mitigation consistent with the goals, objectives, and decisions of the Pinedale RMP (BLM, 1988b), which is currently under revision.

This Draft SEIS documents the analysis of environmental consequences of past and current levels of natural gas development authorized by the PAPA ROD (BLM, 2000b). The Operators' Proposed Action requests development of the natural gas resources beyond the levels of development analyzed and addressed in the PAPA ROD. This Draft SEIS compares existing environmental impacts versus impacts associated with continued development as authorized by the PAPA ROD and subsequent EAs (the No Action Alternative), the Operators' Proposed Action, and an alternative development plan.

The purpose and need of the proposed development is to enable the commercial production of federally owned mineral resources in conformance with the BLM RMP mineral objectives, and to prevent drainage of federal minerals by wells located on adjacent non-federally owned lands. The Operators have valid existing leases and rights to extract natural gas and have proposed to drill an additional 4,399 wells by 2025. Under their proposal, wells would be drilled from fewer pads than the threshold authorized by the PAPA ROD (BLM, 2000b), but the total surface disturbance would be greater than that analyzed in the PAPA DEIS (BLM, 1999a). Implementation of their proposal would require temporary relaxation of seasonal stipulations that currently provide protection to big game on crucial winter habitats and seasonal habitats utilized by greater sage-grouse.

The Operators' Proposed Action would:

- define the extent of natural gas supplies in the PAPA,
- further contribute to the natural gas supply available to the nation,
- consolidate year-round activity to the most productive areas of natural gas development in the PAPA to date,
- provide for compensatory mitigation,
- further reduce national dependence on energy from foreign sources,
- contribute additional supplies of clean-burning fuels, and
- allow the Operators to develop an additional 20 to 25 trillion cubic feet of domestic natural gas under their existing leases granted by the BLM, State of Wyoming, and private landowners.

The exploration and future development of natural gas resources will help to supply the future domestic energy needs and play an integral part in the nation's energy security. Development of additional natural gas resources in the PAPA is consistent with the Comprehensive National Energy Strategy announced by the U.S. Department of Energy in April 1998, the Energy Policy and Conservation Act (42 United States Code [USC] 6201), and the Energy Policy Act of 2005 (Public Law 109-58).

1.8 RELATIONSHIP TO NEPA AND BLM POLICY

The PAPA EIS process was completed in 2000 in compliance with CEQ Regulations for Implementing the Procedural Provisions of NEPA (CEQ, 1978). CEQ described several situations in which federal agencies would prepare supplements to either a DEIS or FEIS (40 CFR § 1502.9(c) if "*the agency makes substantial changes that are relevant to environmental concerns or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts*." In other situations, agencies may prepare supplements to existing documents if they determine that the purposes of NEPA would be furthered by doing so.

To the extent possible and appropriate, BLM supports the use of existing environmental analyses to address impacts of a proposed action as described in Handbook H-1790-1 (BLM, 1988a). Supplements to existing NEPA documents are prepared when additional environmental analyses are needed. The Handbook specifically advises that the *"relationship between the supplement and the existing EIS is lateral, i.e., the proposed action and alternatives are analyzed to the same level of specificity and detail*."

The guidance referenced above cannot be applied to this document because the alternatives analyzed in the PAPA EIS were projections of various development possibilities with incomplete information available regarding 1) the extent of the mineral resource, 2) the pace of development over time, 3) the geographic extent and intensity of development, and 4) environmental impact to multiple resources. BLM now has substantial documentation for each of these four issues associated with natural gas development in the PAPA.

Information now available (which was uncertain in nature during preparation of the PAPA EIS) is used in this document to describe the Affected Environment (Chapter 3) and to analyze the Environmental Consequences (Chapter 4) of the Operators' Proposed Action and other alternatives. The current level of natural gas development in the PAPA has been inventoried and described in Chapter 2. The inventory provides the foundation for understanding the current status of each resource included in Chapter 3 and is the basis for evaluating impact for each alternative in Chapter 4. The current inventory of development and associated impact coupled with the specificity of the Operators' proposal allows for the environmental analyses in this document to be more specific and detailed than in the PAPA EIS.

BLM's Pinedale RMP was approved in 1988 (BLM, 1988b) and is currently being revised. The RMP predicted 900 oil and gas wells would be drilled within the subsequent 20 years. The PAPA EIS noted 725 wells had been drilled as of 1998 and the level of development would exceed that addressed in the RMP. The PAPA EIS provided an analysis of reasonably foreseeable development within the Pinedale RMP area and updated projections made in the 1988 RMP. For air quality impact analysis, this Draft SEIS provides additional evaluation of reasonably foreseeable oil and gas development. BLM expects that implementation of any of the alternatives considered in this Draft SEIS will be in conformance with the revised RMP.

1.9 AUTHORIZING ACTIONS, RELATIONSHIPS TO STATUTES AND REGULATIONS

BLM is not the only agency that must issue approvals for the Operators' proposal. A list of permits, approvals and authorizing actions necessary to construct, operate, maintain and abandon project related facilities is provided in Table 1.9-1. The PAPA EIS contains complete descriptions of the regulatory programs listed below in Table 1.9-1, as well as their applicability to oil and gas activities in the PAPA. For additional information regarding these regulatory programs, please refer to the PAPA EIS.

Table 1.9-1
Permits, Approvals and Authorizing Actions Necessary for Construction, Operation, Maintenance, and Abandonment of Operators' Proposed Action and Alternatives [1]

Issuing Agency/Permit Name	Nature of Permit/Approval	Authority
Bureau of Land Management Permit to Drill, Deepen or Plug Back (APD/Sundry process)	Controls drilling for oil and gas on Federal onshore lands	Mineral Leasing Act of 1920 (30 U.S.C. 181 *et seq*.); 43 CFR 3162
Rights-of-way Grants and Temporary Use Permits	Right-of-way grants on Federal lands	Mineral Leasing Act of 1920 as amended (30 U.S.C. 185); 43 CFR 2880
Rights-of-way Grants and Temporary Use Permits	Right-of-way grants on Federal lands	Federal Land Policy and Management Act of 1976 (43 U.S.C. 1761 - 1771); 43 CFR 2800
Antiquities, Cultural and Historic Resource Permits	Issue antiquities and cultural resources use permits to inventory, excavate or remove cultural or historic resources from Federal lands	Antiquities Act of 1906 (16 U.S.C. Section 431-433); Archaeological Resources Public Protection Act of 1979 (16 U.S.C. Sections 470aa - 47011); 43 CFR Part 3; Section 106 of the National Historic Preservation Act
Approval to Dispose of Produced Water	Controls disposal of produced water from Federal leases	Mineral Leasing Act of 1920 (30 U.S.C. 181 *et seq*.); 43 CFR 3164; Onshore Oil and Gas Order No. 7
U.S. Army Corps of Engineers Section 404 Permit (Nationwide and Individual)	Controls discharge of dredged or fill materials into waters of the United States	Section 404 of the Clean Water Act of 1972 (33 USC 1344)
U.S. Fish and Wildlife Service Consultation Process, Endangered and Threatened Species	Biological Assessment	Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. *et seq*.)
Wyoming Department of Environmental Quality Water Quality Division Notice of Intent - Storm Water Discharge Permit Temporary Discharge Permits	Controls off-site storm water runoff from construction activities resulting in 1 acre or more of disturbance	Wyoming Environmental Quality Act; Section 405 of the Clean Water Act (40 CFR Parts 122, 123 and 124); WDEQ Water Quality Rules and Regulations, Chapters 1, 2, 18
Air Quality Division Permits to construct and operate Notice of Installation	Regulates emissions from project components Notification of Potential Emissions from production equipment	Wyoming Air Quality Standards and Regulations WDEQ Rules and Regulations

Issuing Agency/Permit Name	Nature of Permit/Approval	Authority
Wyoming Department of Transportation Oversize and Overlength Load Permits Utility Permit Access Permit	Permits for oversize, overlength and overweight loads Highway pipeline crossing Highway access construction	Chapters 17 and 20 of the Wyoming Department of Transportation Rules and Regulations Title 12: Code of Civil Procedures, Chapter 26: Eminent Domain Rules and Regulations for Access Driveways as Approved by the Wyoming Highway Commission
Wyoming Oil and Gas Conservation Commission Permit to Drill, Deepen or Plug Back (APD process)	Regulates drilling of all oil and gas wells in the state	Wyoming Oil and Gas Conservation Commission (WOCGG) Regulations Chapter 3, Section 8. W.S. 30-5-104 (d)(i)(C). W.S. 30-5-115
Well location (part of the APD process).	Regulates downhole well location of all oil and gas wells by reservoir or pool	WOGCC Rule: Chapter 3 Section 2, W.S. 30-5-109
Protection of surface waters and productive formations (part of APD process).	Provides general drilling, casing and cementing rules for oil and gas wells.	WOGCC Rule: Chapter 3, Section 22
Well control (part of APD process).	Provides requirements for blowout preventers	WOGCC Rule: Chapter 3, Section 23
Authorization approving drilling and spacing units	Regulates well spacing and pooling of interests by reservoir or pool	W.S. 30-5-104(d)(ii)(F)(iv). W.S. 30-5-109(a),(b),(c) & (f)
Permit to drill to a nonstandard location	Provides for well relocation while maintaining existing well spacing	WOGCC Rule: Chapter 3, Section 3, W.S. 30-5-109
Permit to directionally drill	Provides the notification requirements for controlled directional drilling	WOGCC Rule: Chapter 3, Section 25
Plugging and abandonment of a well (applies to nonfederal lands)	Provides procedures and regulates the plugging and abandonment of oil and gas wells	WOGCC Rule: Chapter 3, Section 18, Chapter 4, Section 2. W.S. 30-5-104 (d)(vi)(B)
Measurement of oil and gas production.	Regulates the measurement and reporting of oil and gas production	WOGCC Rule: Chapter 3, Section 30 and 31, W.S. 30-5-104 (d)(vi)(B)
Permit to complete a well in multiple zones or pools. (Commingling)	Regulates the production of oil and gas from more than one pool in one well	WOGCC Rule: Chapter 3, Section 35
Authorization to flare or vent gas	Regulates the safe venting or flaring of gas to prevent waste	WOGCC Rule: Chapter 3, Section 40
Permit to use an earthen pit (applies to nonfederal lands)	Regulates construction, use and closure of noncommercial reserve, production and emergency pits on drilling and producing locations	WOGCC Rule: Chapter 4, Section 1, W.S. 30-5-104 (d)(vi)(A)
Spills and fires	Requires notification, with a prevention and cleanup plan, of accidental deaths, fires or releases of 10 or more barrels of non-potable fluids that enter or threaten the waters of the State	WOGCC Rule: Chapter 4, Section 3
Workmanlike operations	Regulates the safety and environmental protection of well production facilities	WOGCC Chapter 4, Section 4
Permit underground disposal of water	Regulates the noncommercial underground disposal of non-potable water and oil field wastes	WOGCC Chapter 4, Section 5, W.S. 30-5-104 (d)(vi)(B)
Permit to close a natural gas processing facility	Regulates closure of infield gas gathering and processing facilities	WOGCC Rule: Chapter 4, Section 13 (b)

Issuing Agency/Permit Name	Nature of Permit/Approval	Authority
Wyoming Department of Employment Workers Safety and Compensation Division	Provides the rules and regulations governing the health and safety of employees and employers of oil and gas drilling and servicing, includes equipment spacing, lighting requirements, hours of operation and other items pertinent to pad size and design	W.S. 27-11-105
Wyoming State Engineer's Office Water Well Permit Temporary Industrial Use of Unappropriated Water S.W.1	Grant permit to appropriate groundwater Surface water withdrawal for hydrostatic testing	W.S. 41-121 through 147 Wyoming State Statutes Section 41-3-110
Wyoming State Historic Preservation Office	Cultural resource protection	Section 106 of National Historic preservation Act (NHPA) and Advisory Council Regulations (36 CFR 800)
Wyoming State Lands and Investments	Right-of-way and easements on state lands	W.S. 36-9-118
Sublette County Planning and Zoning	Energy Pipeline Permit	
Planning and Zoning	Driveway Permit	Zoning and Development Regulations of Sublette County Section 7. Wyoming State Statutes Section 18-5-207

[1]This list is intended to provide only an overview of key regulatory requirements that would govern project implementation. Additional approvals, permits and authorizing actions could be necessary.

1.10 DECISIONS TO BE MADE BASED ON THIS NEPA ANALYSIS

BLM decision makers will decide, based on the analysis contained in this Draft SEIS, whether to allow, and under what mitigating conditions to allow, the further development, operation, maintenance, and reclamation of proposed development and associated surface disturbance on federal lands within the PAPA. After completing the SEIS process, a new ROD will be prepared and released that will supersede the PAPA ROD (BLM, 2000b). Although the ROD may approve modification of the Operators' development program, the BLM must analyze and approve each component of the project that involves disturbance of federal lands on a site-specific basis. The method used to evaluate each surface-disturbing activity is the Application for Permit to Drill (APD) or rights-of-way grants/temporary use permits, which would be required before any construction could occur.

Chapter 2
Public Participation, Existing Development and Alternatives

2.1 INTRODUCTION

The purpose of this chapter is to provide an overview of the public participation process, to describe the existing development, and to present alternatives for continued exploration, development, and production of natural gas resources in the PAPA. The project components associated with Alternative A (No Action Alternative), Alternative B (Proposed Action Alternative), and Alternative C are summarized in this chapter. Other project alternatives considered, but not analyzed in detail, are also discussed in this chapter. This chapter describes the expansion of transportation corridors, proposed gas sales pipelines from the PAPA to gas processing plants in southwestern Wyoming, and expansion of the Granger Gas Processing Plant.

2.2 PUBLIC PARTICIPATION

2.2.1 Scoping, Consultation and Coordination

NEPA regulations (40 CFR 1500–1508) require BLM to use a scoping process to identify potential significant issues in preparation for impact analysis. The principal goals of scoping are to allow public participation and to identify issues, concerns, and potential impacts that require detailed analysis. Scoping was the primary mechanism used by the BLM to identify concerns regarding proposed development in the PAPA.

A number of meetings/announcements involving the BLM, the Operators, various agencies, and the public have been held to encourage early and improved public participation and agency cooperation. The BLM's Notice of Intent (NOI) to prepare a Supplemental EIS inviting the public to comment on the Operators' proposal for long-term development of the PAPA appeared in the Federal Register on October 21, 2005. BLM mailed a scoping notice to the media, governmental agencies, environmental organizations, industry representatives, individuals, landowners, and livestock grazing permittees. The scoping notice explained the general nature of the project and requested comments. The formal public scoping comment period ended November 20, 2005. Scoping meetings were held in Jackson and Marbleton on November 7, 2005, and in Pinedale on November 8, 2005.

The locations of the proposed transportation corridor/pipeline alignments were not determined at the time of the initial scoping; therefore, an additional scoping notice was mailed. The second notice, mailed on April 14, 2006, was sent to the same recipients as the October 2005 scoping notice, and also individuals and organizations on mailing lists associated with the BLM Rock Springs and Kemmerer field offices. The formal public comment period for the second scoping notice ended on May 17, 2006.

Numerous concerns were identified through the formal scoping process. Comments received during scoping were incorporated into the analysis and are available for inspection in BLM's Pinedale, Kemmerer and Rock Springs field offices. The agencies and government entities that were consulted in the scoping process include the WGFD, U.S. Fish and Wildlife Service (FWS), USFS, National Park Service (NPS), Environmental Protection Agency (EPA), the State of Wyoming, Sublette County, and the BLM Interdisciplinary Team (ID Team). The concerns identified are summarized below in Section 2.2.2 and are detailed in Appendix B.

The BLM ID Team considered all comments received during the scoping process. From the breadth of key environmental concerns submitted by agencies and the public, the ID Team developed alternatives that are described in later sections of this chapter. The comments provided guidance for analysis of impact to each resource addressed in Chapters 3 and 4.

2.2.2 Summary of Concerns

Following the November 2005 scoping, BLM received a total of 63 written comments, nine of which were from government agencies (two federal, five state, and two county), four from industry representatives, five from environmental organizations, and 45 from private individuals. Following the April 2006 scoping of the proposed transportation corridor/pipeline alignments, BLM received a total 10 written comments. Five of the comments were from government agencies (three federal, one state, and one county) and five were from private individuals.

Concerns introduced by the public, industry, interested groups, and other agencies are summarized below:

- The pace of development in the PAPA is too fast and BLM has not fully evaluated the environmental consequences of winter drilling, operators' mitigation, compliance with all regulatory standards, and application of adaptive management;
- BLM should analyze an alternative that emphasizes conservation and wildlife in the PAPA;
- The impact to wildlife by current development has been a major concern. Although monitoring must continue, new approaches to mitigation should be developed and monitored;
- The effects on livestock operators and private landowners by wildlife displaced due to development in the PAPA should be evaluated on-site and off-site, and mitigation should be proposed;
- Winter drilling will increase winter traffic and cause increased safety risks;
- The effect of winter drilling on the economic stability in Sublette County over the long-term should be evaluated;
- Industrialization on public and private lands has become a single resource use of land, not multiple use;
- Hunting is impacted by declining wildlife populations;
- Wellfield development is impacting surface water and groundwater; and
- Air quality in the region should be fully evaluated with respect to sensitive airsheds and local air quality, and mitigation measures should be proposed, where necessary.

2.3 EXISTING DEVELOPMENT WITHIN THE PAPA

Many of the written responses to scoping referred to concerns about the existing development in the PAPA. The extent of the existing development in the PAPA together with the approved components in the PAPA ROD (BLM, 2000b) provides the baseline for evaluating each alternative described in Section 2.4. The analyses and discussions that follow provide a current inventory of natural gas development since the PAPA ROD was issued.

In addition to the extent of development, respondents to scoping focused on the pace of development in the PAPA. The number of wells drilled and completed during any given year is the pace of development. The amount of gas produced is more reflective of market conditions, which might result in conditions favorable for an Operator to increase the pace of development. The number of producing wells at the end of 2001, the first full year after the PAPA ROD was issued, was 38; at the end of 2005 there were approximately 457 producing wells. Natural gas production in 2005 was approximately 12 times greater than production in 2001 (Table 2.3-1). Condensate and water production have also increased each year in the PAPA.

Table 2.3-1
Total Annual Production of Natural Gas, Condensate, and Produced Water in the PAPA Since 2000

Year	Natural Gas (MCF)	Condensate (Bbls)	Produced Water (Bbls)
2000	8,195,121	78,621	118,018
2001	14,946,294	143,378	193,261
2002	41,909,699	376,726	476,903
2003	80,504,011	649,687	1,434,565
2004	136,329,573	1,075,210	2,876,604
2005	179,160,224	1,407,162	4,167,555
Source: Wyoming Oil and Gas Conservation Commission			

While the level and rate of development in the PAPA is much greater than predictions in the PAPA DEIS (BLM, 1999a), it is not unusually high for an emerging gas field. Since approval of the PAPA ROD (BLM, 2000b), better definition of the resource places the Pinedale Anticline Field as the third largest natural gas field in the nation (WOGCC, 2006).

2.3.1 Limitations in the PAPA ROD

2.3.1.1 Project Components

The PAPA ROD (BLM, 2000b) authorized project components on BLM administered federal lands and minerals within the PAPA (see Table 2.3-2). The PAPA ROD (BLM, 2000b) stated that authorized development beyond the specified levels would require additional supplemental environmental impact analysis. For all analyses of impacts in this Draft SEIS, activities proposed for 2006 are included within the existing environmental baseline because development is ongoing during 2006 while this document is being prepared. Wellfield components authorized by the PAPA ROD, and summarized in Table 2.3-2, will not reach the threshold limits on development before the end of 2006.

Table 2.3-2
PAPA ROD Approved Components Compared to Development since the PAPA ROD[1]

PAPA ROD Approved Component	Number	Development (July 2000 through December 2005)	Projected Development During 2006	Estimated Total Development Through 2006
initial well pad locations on all lands and minerals within the PAPA	900 well pads	266 well pads	26 well pads	292 well pads
producing wells and/or well pads on all lands and minerals within the PAPA	700 wells or well pads[2]	428 wells	205 wells	633 wells
production facilities at individual well locations	700	Less than 431	Less than 205	Less than 636
central off-site production facilities	None specified	none	none	none
compressor facility sites	4	3	none	3
BP Amoco Field Office	1	none	none	none

PAPA ROD Approved Component	Number	Development (July 2000 through December 2005)	Projected Development During 2006	Estimated Total Development Through 2006
miles of sales pipeline corridor for multiple pipelines	121.5	14.5 (within the PAPA)	none	14.5 (within the PAPA)
miles of access road (including collector, local and resource roads)	276.0	176.5	6.7	183.2
miles of gathering pipeline system	280.0	134.2	7.4	141.6
[1] Totals do not include 56 well pads constructed and 29 producing wells drilled before July 2000. [2] See Section 1.3 in Chapter 1 for discussion on ambiguity of PAPA ROD regarding well and well pads.				

2.3.1.2 Management Area Well Pad Thresholds

BLM's Preferred Alternative (*Resource Protection Alternative on Federal Lands and Minerals*), developed in the PAPA DEIS (BLM, 1999a) and authorized by the PAPA ROD (BLM, 2000b), was implemented through restrictions on exploration and wellfield development within each of nine MAs. Section 4 of the PAPA ROD provided specific limits of development within each of the nine MAs based on numbers of producing well pads. The PAPA ROD specifies that if well pad density limits are reached for a MA, additional environmental analysis would be required. Management objectives for each MA were developed in the PAPA DEIS (BLM, 1999a) and authorized in the PAPA ROD.

The largest single area of development since the issuance of the PAPA ROD (BLM, 2000b) is well pad construction in MA 5 - *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat* (Table 2.3-3), with an estimated 129 well pads at the end of 2006. The highest density of pads is within MA 9 - *Non-Federal Lands* in Section 16, T. 32 N., R. 109 W., a state owned section surrounded by federal lands in MA 5.

Table 2.3-3
Management Area Limitations and Current Status of Well Pads

Management Area Limitations for Resource Protection in the PAPA ROD	Estimated Current Status of Well Pad Limitation July 2000 through 2006
MA 1 - Lander Trail	
total producing pads threshold	0 total producing pads
MA 2 - Mesa Breaks	
0 total producing pads threshold	0 total producing pads
MA 3 - Unleased Federal Minerals	
0 total producing pads threshold	0 total producing pads
MA 4 - Sensitive Viewshed	
28 total producing pads threshold	5 total producing pads
MA 5 - Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat	
212 total producing pads threshold	129 total producing pads
MA 6 - Sage Grouse Strutting and Nesting Habitat	
183 total producing pads threshold	45 total producing pads
MA 7 - Ross Butte/Blue Rim	
68 total producing pads threshold	30 total producing pads
MA 8 - Minimal Conflict Area	
168 total producing pads threshold	32 total producing pads
MA 9 – Non federal Lands[1]	
200 total producing pads threshold	51 total producing pads
[1] BLM does not have jurisdiction on non-federal lands.	

Currently, none of the thresholds for well pads in the individual MAs has been reached. *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat* (MA 5) and *Ross Butte/Blue Rim* (MA 7) are the most developed with approximately half of the allowable well pads constructed. For MA 5, 129 pads have been constructed out of 212 allowable well pads, and 30 well pads have been constructed of the 68 pads allowed in MA 7.

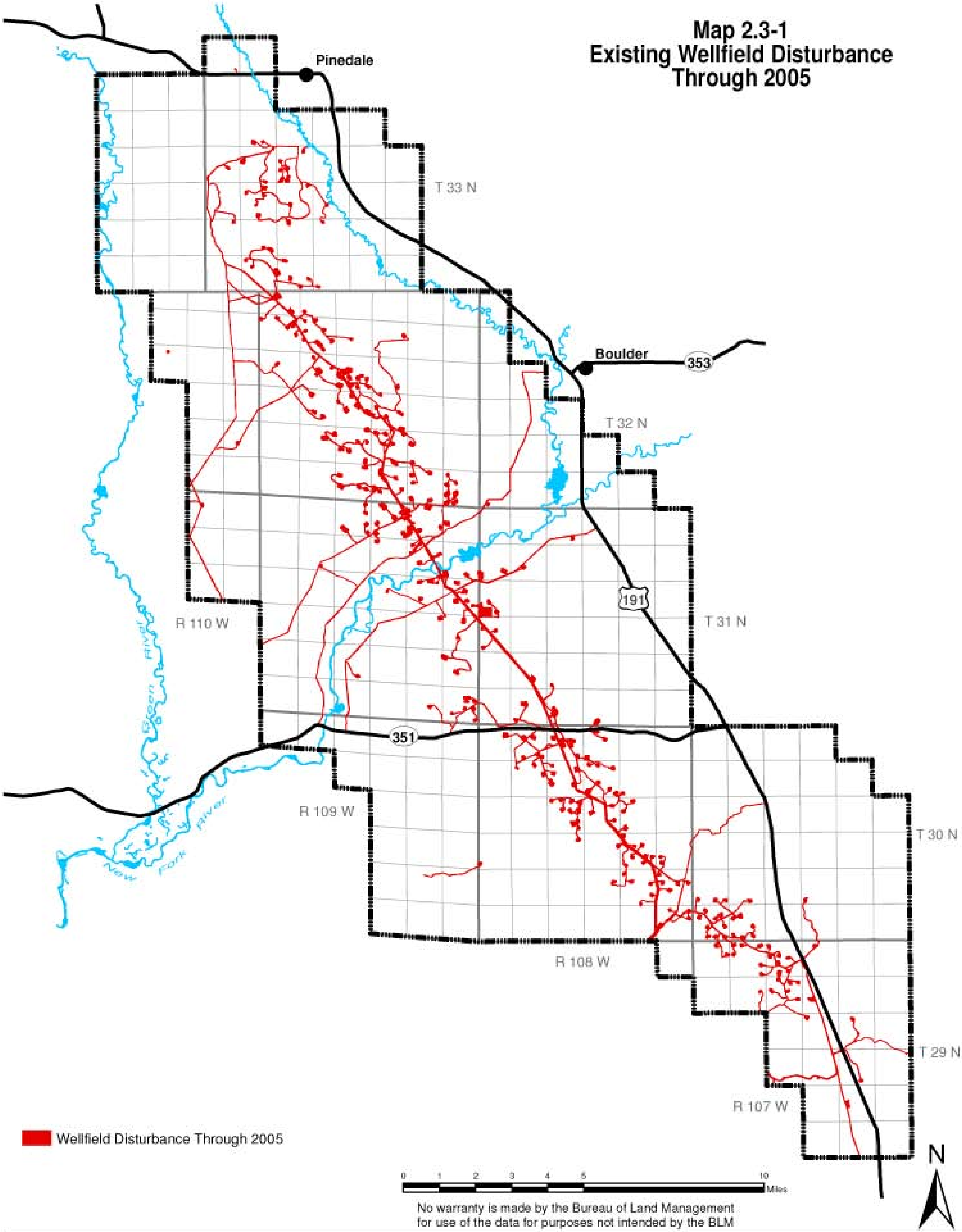
2.3.1.3 Air Quality Analysis Threshold

Since the PAPA ROD (BLM, 2000b) was issued, natural gas development within the PAPA has occurred at a faster pace than was analyzed in the PAPA DEIS (BLM, 1999a). The PAPA ROD specified a threshold for emission analysis levels of 376.59 tpy of NO_x from compression, and 693.50 tpy of NO_x from all sources in the field. The PAPA ROD states that if these analysis levels are exceeded, additional analysis would be conducted. The air quality impact assessment modeling for the PAPA DEIS assumed 900 initial wells drilled, with 700 producing wells and up to eight drilling rigs operating in the PAPA at any one time. As of December 2005, there were 457 producing wells and 26 drilling rigs operating in the PAPA. However, of the 457 producing wells, only 428 wells are subject to the analysis thresholds in the PAPA ROD because 29 producing wells were existing prior to issuance of the PAPA ROD. The Operators projected an additional 205 producing wells in 2006 for a total of 662 producing wells (633 subject to the analysis thresholds in the PAPA ROD). Subsequent NEPA analysis (BLM, 2004a) disclosed that the NO_x emissions from all sources in the PAPA had exceeded the 693.50 tpy analysis threshold specified in the PAPA ROD, mostly due to the increased number of drilling rigs.

2.3.2 Surface Disturbance by Wellfield Component

Total surface disturbance, by wellfield component, through December of 2005 was determined from digitized QuickBird Satellite Imagery (resolution of 0.6 meter, digitized at a scale of 1:2,000). Well pads with a variety of features (wellheads, pits, tank batteries) were clearly visible on the imagery as were roads and pipelines. When the digitized wellfield disturbance was compared with ground truth, revegetated and nonvegetated areas were not consistently distinguishable. Some portions of well pads and pipelines identified as revegetated in the imagery were found to be newly disturbed. Therefore, all portions of well pads, roads, and pipelines were assumed to be disturbed. Map 2.3-1 shows the existing natural gas related disturbance in the PAPA as of December 2005, including areas disturbed before issuance of the PAPA ROD (BLM, 2000b).

Disturbance in 2006 has been projected by the Operators and is not shown on Map 2.3-1. Table 2.3-4 provides the total estimated disturbance in the PAPA as a result of natural gas development through 2006 (5,059 acres). However, only disturbance that has occurred since July 2000 is subject to the limits in the PAPA ROD (BLM, 2000b) which is estimated to be 4,679 acres. Although the PAPA ROD did not place limits on total surface disturbance from wellfield activity, it did place limits on disturbance associated with roads and gathering pipelines in terms of lineal dimensions rather (miles) than area disturbed (acres). Most surface disturbance has been concentrated along the Anticline Crest (see Map 2.3-1).



Map 2.3-1
Existing Wellfield Disturbance
Through 2005
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
0 1 2 3 4 5 10
Miles
N
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for use of the data for purposes not intended by the BLM

Table 2.3-4
Estimated Total Surface Disturbance in the PAPA as a Result of Natural Gas Development through 2006

Wellfield Component	Number or Miles	Total Area Disturbed (acres)
Before PAPA ROD		
Well Pads	56 pads	332.1
Roads	32.7 miles	168.7
Gathering Pipelines	12.1 miles	60.2
	Total	**561.0**
Since PAPA ROD		
Well Pads	266 pads	1,808.0
Roads	176.5 miles	913.0
Gathering Pipelines	134.2 miles	804.8
Sales Pipelines	14.5 miles	437.9
Compressor Stations	3 sites	27.2
Stabilizer Facility	1 site	5.7
Anticline Disposal Facility	1 site	72.0
Yards	6 sites	48.9
	Total	**4,117.5**
Proposed 2006		
Well Pads	26 pads	300.5
Roads	5.9 miles	30.7
Gathering Pipelines	7.9 miles	47.1
Compressor Station	1 site	2.6
	Total	**380.9**
	Grand Total	**5,059.4**

2.3.2.1 Well Pads

As of December 2005, there were 322 well pads in the PAPA, of which 56 were constructed before issuance of the PAPA ROD (BLM, 2000b); 266 well pads have been constructed since July 2000 (see Table 2.3-4). The Operators are projecting to construct 26 well pads in 2006, for a total of 292 well pads that would be subject to the limit of 700 producing well pads in the PAPA ROD. Therefore, the threshold for total well pads in the PAPA ROD will not have been reached by the end of 2006.

2.3.2.2 Roads and Gas Gathering Pipelines

Before issuance of the PAPA ROD (BLM, 2000b), there were 168.7 miles of road associated with natural gas development in the PAPA. The PAPA ROD approved additional construction and/or upgrade of access roads on BLM administered lands, including collector, local, and resource roads totaling approximately 276 miles. The roads in the PAPA are classified as follows:

- Arterial roads with high traffic volumes that pass through the PAPA such as state highways or county roads (not subject to limitations in the PAPA ROD);

- Two-lane collector roads that provide primary access to large blocks of land and connect with or extend the public road system;
- One or two-lane local roads that connect to collector roads but which normally serve a smaller area and convey less traffic than collector roads; and
- Single lane resource roads from individual well pads to local or collector roads.

Approximately 176.5 miles of local and resource roads have been constructed and/or improved since the PAPA ROD (BLM, 2000b) was issued. The Operators are projecting an additional 5.9 miles of road in 2006 (Table 2.3-5). Together, an estimated total of 182.4 miles of road in the PAPA are subject to the 276-mile limit in the PAPA ROD which includes upgrading roads on lands managed by BLM that were present before issuance of the PAPA ROD. The threshold for roads in the PAPA ROD will not have been reached by the end of 2006. Map 2.3-2 shows the existing road network in the PAPA.

Table 2.3-5
Existing Roads within the PAPA by Road Category

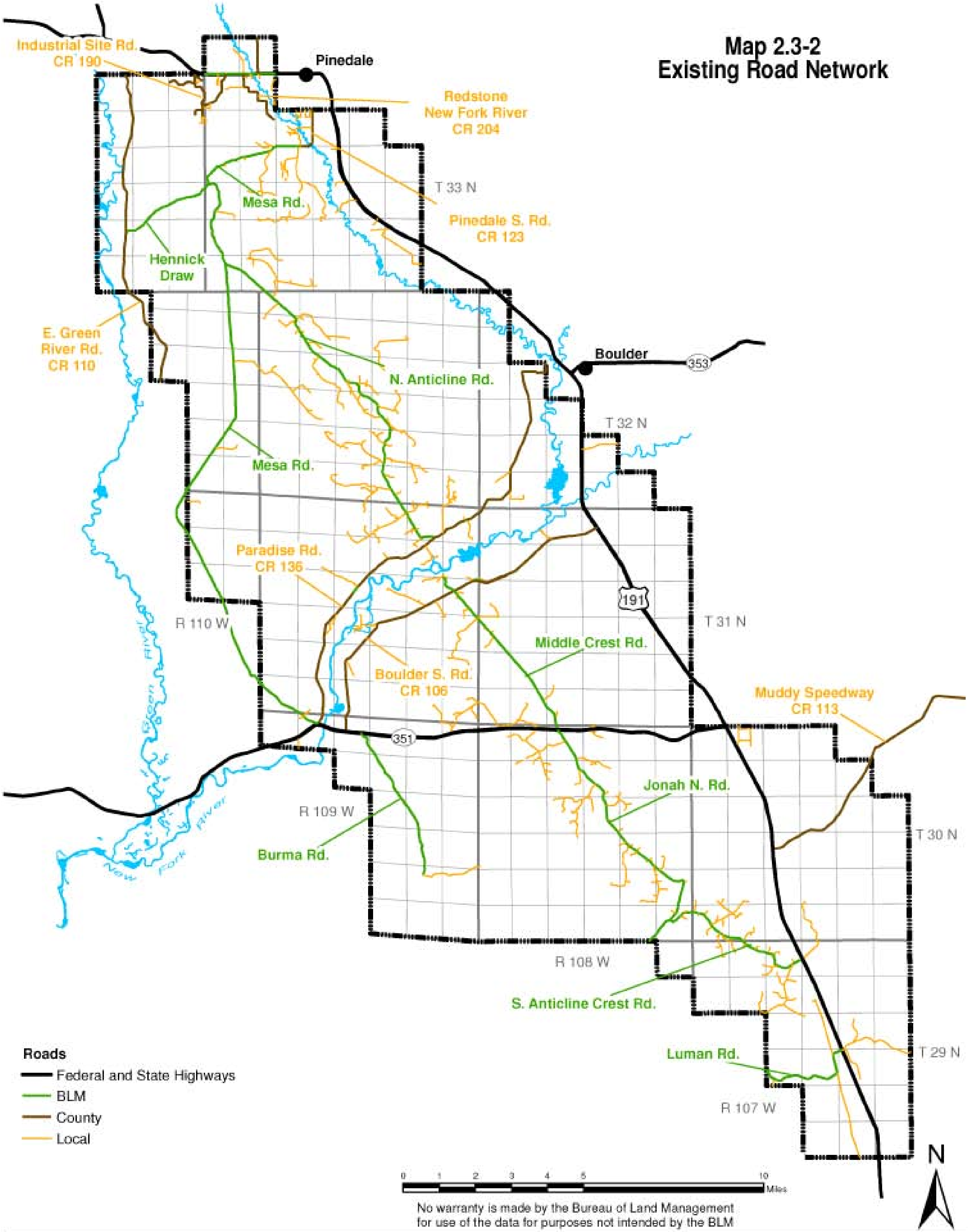
<table>
<tr><th rowspan="2">Road Category</th><th colspan="2">Roads Constructed July 2000 through December 2005 Since the PAPA ROD</th><th colspan="2">Projected Roads in 2006</th><th colspan="2">Estimate of all Roads Existing in the PAPA Subject to PAPA ROD Limitations</th></tr>
<tr><th>Length (miles)</th><th>Disturbance (acres)</th><th>Length (miles)</th><th>Disturbance (acres)</th><th>Length (miles)</th><th>Disturbance (acres)</th></tr>
<tr><td>Arterial</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr>
<tr><td>Collector</td><td>64.1</td><td>396.5</td><td>0.0</td><td>0.0</td><td>64.1</td><td>396.5</td></tr>
<tr><td>Local</td><td>52.2</td><td>235.5</td><td rowspan="2">5.9</td><td rowspan="2">30.7</td><td rowspan="2">118.3</td><td rowspan="2">547.2</td></tr>
<tr><td>Resource</td><td>60.2</td><td>281.0</td></tr>
<tr><td>Total</td><td>176.5</td><td>913.0</td><td>5.9</td><td>30.7</td><td>182.4</td><td>943.7</td></tr>
</table>

The PAPA ROD (BLM, 2000b) approved an additional 280 miles of gathering pipelines to carry natural gas from individual well pads to a central location where the gas would be compressed into a sales pipeline. The approval included construction and operation of 3- to 16-inch diameter gathering pipelines. Approximately 134.2 miles of gathering pipeline have been constructed between July 2000 and December 2005, with an additional 7.9 miles of gas gathering pipeline projected in 2006. The total of 142.1 miles of gathering pipeline is below the limit allowed by the PAPA ROD.

In 2005, Questar installed a condensate and produced water gathering system within their leaseholds in the northern portion of the PAPA. Potential environmental impacts for the gathering system were evaluated by BLM (2004a). The PAPA DEIS (BLM, 1999a) did not consider installation and operation of a liquid gathering system, or for transportation of these produced liquids from the PAPA to sales and disposal facilities. Therefore, the liquids gathering system is not considered part of the gathering pipeline limit set forth in the PAPA ROD.

2.3.2.3 Gas Sales Pipelines

The PAPA ROD (BLM, 2000b) approved a route, including two alternative alignments, with a 200-foot wide right-of-way to accommodate multiple gas sales pipelines. Depending on alternatives, the route ranged from 119.6 to 121.7 miles. The PAPA ROD approved a 121.5-mile route. Currently, a portion of the constructed gas sales pipeline extends for 14.5 miles within the PAPA with an estimated disturbance of 437.9 acres.


Map 2.3-2
Existing Road Network
Industrial Site Rd.
CR 190
Pinedale
Redstone
New Fork River
CR 204
T 33 N
Mesa Rd.
Pinedale S. Rd.
CR 123
Hennick
Draw
E. Green
River Rd.
CR 110
Boulder
353
N. Anticline Rd.
T 32 N
Mesa Rd.
Paradise Rd.
CR 136
191
R 110 W
T 31 N
Middle Crest Rd.
Boulder S. Rd.
CR 106
Muddy Speedway
CR 113
351
Green River
Jonah N. Rd.
R 109 W
New Fork River
T 30 N
Burma Rd.
R 108 W
S. Anticline Crest Rd.
Roads
Federal and State Highways
BLM
County
Local
Luman Rd.
T 29 N
R 107 W
N
0 1 2 3 4 5 10
Miles
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for use of the data for purposes not intended by the BLM

2.3.2.4 Compressor Stations

The PAPA ROD (BLM, 2000b) allowed for authorization of four compressor station sites within the PAPA. There are currently three compressor stations in the PAPA including the Pinedale/Gobblers Knob Compressor Station operated by QGM (Section 2, T. 31 N., R. 109 W.); and the Paradise Compressor Station (Section 2, T. 31 N., R. 109 W.), and the Falcon Compressor Station (Section 36, T. 30 N., R. 108 W), which are both operated by JGGC. Total compression for the three stations is 58,948 horsepower (hp) for the compressor engines, with an additional 7,690 hp associated with generators and vapor recovery units for a total of 66,638 hp.

As of December 2005, the three facilities covered 27.2 acres. The horsepower shown in Table 2.3-6 includes an expansion of the Pinedale/Gobblers Knob Compressor Station in 2006, with an additional 7,440 hp of compression and 2.6 acres of disturbance. The projected disturbance for the compressor stations in the PAPA by the end of 2006 is 29.8 acres. The total NO_x emission for all compression within the PAPA by the end of 2006 is 472.2 tpy.

Table 2.3-6
Compressor Stations, Existing Horsepower with Corresponding NO_x Emissions in the PAPA through 2006

Station Name/Owner	Existing Compression (hp)	Existing Generation (hp)	Existing VRU (hp)	Total Compression (hp)	NO_x Emission (tpy)
Pinedale/Gobblers Knob	18,600[1]	0	0	18,600 [1]	125.7
Paradise	18,340	3,600	245	22,385	161.2
Falcon	22,008	3,600	245	25,853	185.3
Total	**58,948**	**7,200**	**490**	**66,638**	**472.2**

[1] Includes 7,440 hp installed in 2006.

The PAPA ROD (BLM, 2000b) allowed for varying levels of compression, depending upon the compressor emissions rating, the level of construction and drilling activity, and the number of producing wells. The current level of 66,638 hp is within the amount of compression analyzed in the PAPA DEIS (26,000 to 96,000 hp with compressor emission ratings of 1.5 to 0.7 g/hp-hr, respectively). However, the total NO_x emission of 472.2 tpy is over the 376.59 tpy NO_x analysis threshold specified in the PAPA ROD.

2.3.2.5 Stabilizer Facility

Disturbance associated with the expansion of the Pinedale/Gobblers Knob Compressor Station for the stabilizer facility was analyzed under NEPA (BLM, 2004a) and included an additional 5.7 acres. QGM modified their plans to include a condensate stabilizer and water handling facility. The purpose of the condensate stabilizer is to make a “stable” product that can be metered and pumped to the crude petroleum pipeline for transport off the PAPA. The modification was analyzed under NEPA by BLM, and a Documentation of Land Use Plan Conformance and NEPA Adequacy, or DNA, was issued in 2005. It included installation of an underground 25 kV three-phase power distribution line to connect the condensate stabilizer to the Pinedale/Gobblers Knob Compressor Station.

2.3.2.6 Anticline Disposal Facility

The Anticline Disposal Facility, which disposes of produced water by evaporation and surface discharge (proposed to begin in 2007), is located in Section 18, T. 31 N., R. 108 W. and Section

13, T. 31 N., R. 109 W. The 72.0-acre site is located entirely on private land. BLM has issued rights-of-way for pipelines and roads to and from the facility.

2.3.2.7 Storage Yards

There are seven storage yards located within the PAPA that are located within various Operator leaseholds. The total surface disturbance for the storage yards is 49.0 acres.

2.3.3 Drilling Rigs

Restrictions on numbers of drilling rigs present at any time within the PAPA were not carried forward from the PAPA DEIS (BLM, 1999a) and the PAPA FEIS (BLM, 2000a) to the PAPA ROD (BLM, 2000b). BLM concluded that limiting the number of rigs (on federal and nonfederal lands and minerals, combined) would be difficult to manage. Furthermore, BLM noted that seasonal restrictions to protect wildlife under the Preferred Alternative (*Resource Protection Alternative on Federal Lands and Minerals*) would impose limits on numbers of rigs within specific MAs and would control numbers of rigs operating within the PAPA. Other factors, including, but not limited to, the availability of rigs and workers, market price of natural gas, and budgetary constraints, would contribute to limit drilling rigs working at any one time.

The number of drilling rigs operating in the PAPA has increased since issuance of the PAPA ROD (BLM, 2000b). In each year, the fewest rigs have been present between November and April, which corresponds with BLM's standard practice of not allowing activities or surface use from November 15 through April 30 within big game crucial winter ranges. There has been an increase in wells drilled and drilling rigs present each month during winter from 2003-2004, due to the exceptions granted by BLM and the Decision Records for several limited winter drilling proposals (BLM, 2004a, 2005a, 2005b, and 2005c).

Based on available data (RigData, 2006), drilling rigs averaged 62 days to drill wells to depths averaging 13,600 feet. There is considerable variation in the average amount of drilling time and bottom-hole depth, regardless of which geologic formation was targeted. Efficiency improves as more wells are drilled, and the Operators have estimated that most wells could be drilled within 50 days. The deepest well to date was drilled to a depth of 19,520 feet, is completed to the Lance Pool, and is in the production phase. All of the deeper intervals were tested and they produced uneconomic quantities of natural gas.

2.3.4 Other Approved Components

Production Facilities. The PAPA ROD (BLM, 2000b) authorized up to 700 production facilities on individual well pad locations. Production facilities include tanks, separators, dehydration units, remote telemetry, and other equipment. Most of the well pads with producing wells have dedicated production facilities, although, some production facilities are shared.

Central/off-site production facilities (C/OSPF's) were envisioned in the PAPA ROD (BLM, 2000b) for efficient operation of wells and/or to avoid or minimize disturbance to sensitive resources (wildlife, sensitive viewsheds, etc.) on 80- and 40-acre well spacing. The PAPA ROD allowed for authorization of C/OSPF's on a case-by-case basis. Directional drilling one or more wells from a single pad was also envisioned and could be authorized on a case-by-case basis. Currently, there are no C/OSPF's within the PAPA, although there has been extensive directional drilling since July 2000.

Water Wells. The PAPA ROD (BLM, 2000b) allowed for authorization of surface water and/or water supply wells drilled on gas well pads as water sources for drilling, completions, pipeline hydrostatic testing, and dust abatement. There were no limits placed on the number of water supply wells in the PAPA ROD, and there are approximately 98 Operator-drilled water wells being monitored in the PAPA. Well depths range from 120 to 1,040 feet averaging 638 feet. Most of the Operator-drilled water wells are on gas well pads.

Field Office. Another authorized component is the BP Amoco Field Office that was proposed to be located on a 5-acre site in SW ¼ Section 23, T. 29 N., R. 107 W. The field office has not been constructed.

Central Delivery Points. In 2005, QGM constructed three Central Delivery Point (CDP) facilities within Questar's leasehold, all of which were constructed on existing pads within existing disturbance. The purpose of the CDPs is to receive condensate, produced water, and natural gas from producing wells. The three CDPs were located on existing pads within existing disturbance at Mesa 15-06, Stewart Point 16-18, and Mesa 14-16 well pads. Impacts associated with construction and operation of the CDPs on federal surface were analyzed under NEPA, and Categorical Exclusions (CXs) were issued. The CDP located on the Mesa 14-16 well pad is on a state lease. An underground 25 kV three-phase power distribution line to the CDPs was analyzed and was installed in 2005.

Water Handling Facility. QGM proposed to install a water storage facility near Highway 351. Impacts associated with the emergency tank storage facility were analyzed under NEPA by BLM, and an EA was issued; however, the facility was not constructed.

2.4 ALTERNATIVES

This section briefly discusses the alternatives analyzed in detail in the PAPA DEIS (BLM, 1999a), introduces the alternatives analyzed in detail in this Draft SEIS, and presents alternatives considered, but not analyzed in detail.

2.4.1 Alternatives Analyzed in the PAPA DEIS

The PAPA DEIS (BLM, 1999a) analyzed three action alternatives; the *Standard Stipulation Alternative*, the *Resource Protection Alternative on Federal Lands and Minerals*, and the *Resource Protection Alternative on All Lands and Minerals*.

2.4.1.1 Standard Stipulation Alternative

This alternative assumed that either 500 or 700 producing well pads would be developed entirely under BLM's Standard Mitigation Guidelines (Appendix A of the PAPA DEIS), with lease stipulations on development issued at the time of leasing. Impact analysis was based on an average of up to eight drilling rigs operating within the PAPA year-round. Unless required by lease stipulations, the *Standard Stipulations Alternative* generally did not limit the density of development (the number of potential well pad locations per section) within any of the SRMZs. In most cases, the alternative addressed anticipated impact from locating up to 16 well pads per section in each of the SRMZs.

2.4.1.2 Resource Protection Alternative on Federal Lands and Minerals

This alternative analyzed the impacts of implementing the *Resource Protection Alternative* on only Federal Lands and Minerals. This alternative assumed that either 500 or 700 well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. It disclosed the types of impacts that would remain even if BLM implemented additional controls to reduce undue impacts. It evaluated the benefits of slower paced development by limiting the number of rigs operating annually in the PAPA to five. Finally, the alternative addressed the application of pad drilling and centralized production facilities as additional mitigation measures. This alternative considered pad drilling as an option for reducing surface disturbance and human presence in the PAPA. The term refers to multiple wells with different bottom-hole locations directionally drilled from a single surface well pad. Use of centralized production facilities was advanced in this alternative to eliminate storage of condensate and produced water on each well pad, collecting them at central locations. This alternative, as modified in the PAPA ROD (BLM, 2000b), was implemented by BLM.

2.4.1.3 Resource Protection Alternative on All Lands and Minerals

This alternative analyzed the impacts of implementing the *Resource Protection Alternative* throughout the PAPA (on all lands and minerals). This alternative assumed that either 500 or 700 well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. The implementation of mitigation measures (pad drilling and centralized production facilities) on all lands in the PAPA was evaluated.

2.4.2 Alternatives Analyzed in Detail

The No Action Alternative (Alternative A), the Proposed Action Alternative (Alternative B) and Alternative C, are analyzed in detail in this Draft SEIS. The No Action Alternative is analyzed through 2011. The Proposed Action (Alternative B) and Alternative C are analyzed through 2023 with intermediate analyses in 2011. There are project components that are common to all alternatives and are discussed below.

2.4.2.1 Components Common to All Alternatives

Transportation Requirements. The number of vehicles in and out of the PAPA on a daily basis varies seasonally. During the development period (through 2011 for the No Action Alternative and 2023 for the Proposed Action and Alternative C) and production period (through 2051 for the No Action Alternative and 2065 for the Proposed Action and Alternative C), traffic would be much greater in summer than in winter, due to traffic required for construction of roads, pads and pipelines. Workers, material, and equipment would be transported to the PAPA over U.S. Highways 191 and 189, State Highway 351, and county and BLM roads located within the PAPA. A comparison of traffic requirements for each of the alternatives for 2009 with and without the proposed liquid gathering system is provided in Table 2.4-1 below. A Transportation Plan developed by some of the Operators for the Proposed Action Alternative is provided in Appendix C.

Table 2.4-1
Comparison of Traffic (vehicles per day) During Development for all Alternatives in 2009

	No Action Alternative			Proposed Action Alternative and Alternative C		
	Light	**Heavy**	**Total**	**Light**	**Heavy**	**Total**
Summer	1,959	1,034	2,993	622	595	1,217
Winter without gathering	1,589	665	2,254	N/A	N/A	N/A
Winter with gathering	N/A	N/A	N/A	521	443	964

Workforce Requirements. The estimated workforce requirements provided by the Operators to develop a single well in the PAPA are provided in Table 2.4-2.

Table 2.4-2
Workforce Requirements Necessary to Develop a Single Well in the PAPA

Category	Average Number of Workers	Average Number of Days
Well Pad and Access Road Construction	15	5
Rig Up/Down	15	5
Drilling	25	50
Testing and Completion	20	12

Mitigation Requirements. BLM would incorporate environmental Best Management Practices (BMPs) into the APD Surface Use Plan of Operations by the Operator under all alternatives. BMPs are provided in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* – a joint effort by DOI and USDA (2006), also known as the Gold Book.

Pipeline Corridors. The BLM proposes the designation of three pipeline corridors to support construction and operation of future pipelines for transport of natural gas related production (natural gas, crude petroleum and produced water) from the PAPA (see Map 2.4-1). The corridors would mostly parallel, and be located adjacent to, existing pipeline corridors connecting the PAPA with natural gas processing plants in southwestern Wyoming. The BLM has determined the need for such corridors based on:

- continued success in the development of natural gas resources in the PAPA;
- indications, initial plans, and actual proposals by industry for the construction and operation of additional pipeline capacity to transport the increasing volumes of natural gas and other hydrocarbon products from the PAPA and Jonah Field Project Area to market;
- an agency determination that the existing pipeline corridors are full; and
- provisions of the 2005 Energy Policy Act encouraging location of pipelines in common corridors and providing for expedited NEPA approvals.

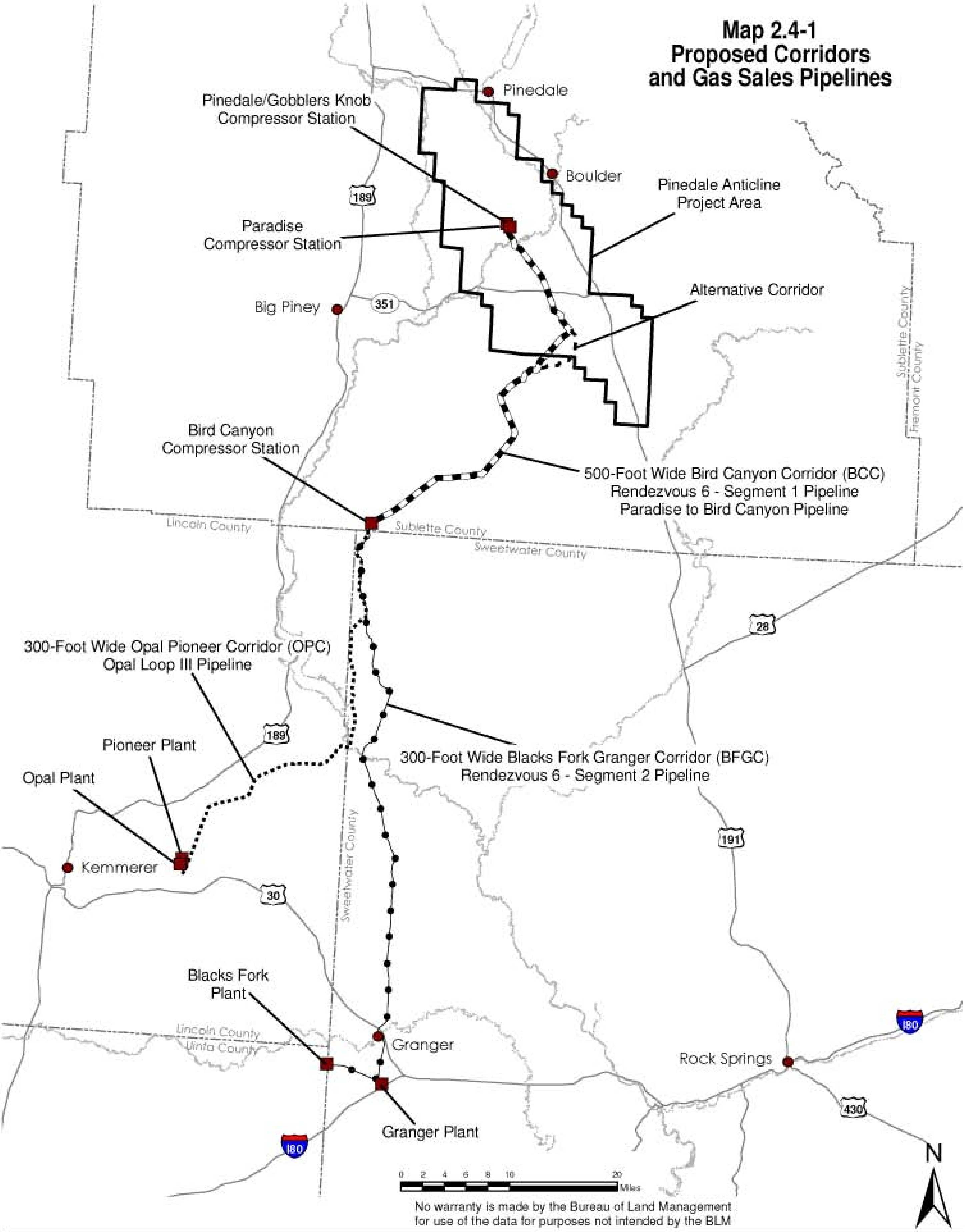
The proposed pipeline corridors are discussed below:

1. The 500-foot wide, 41.5-mile long Bird Canyon Corridor (BCC) would mostly parallel and be adjacent to the existing 200-foot wide pipeline corridor between the PAPA (Pinedale/Gobblers Knob and Paradise compressor stations, Section 2, T. 31 N., R. 109 W.) and the Bird Canyon Compressor Station (Section 34, T. 27 N., R. 111 W.)
2. The 300-foot wide, 62.1-mile long Blacks Fork Granger Corridor (BFGC) would mostly parallel and be adjacent to the existing 200-foot wide pipeline corridor between the Bird Canyon Compressor Station and the Blacks Fork Gas Processing Plant (Section 10, T. 18 N., R. 112 W.) with an intermediate connection into the Granger Gas Processing Plant (Section 16, T. 18 N., R. 111 W.).
3. The 300-foot wide, 45.5-mile long Opal Pioneer Corridor (OPC) would mostly parallel and be adjacent to the existing 200-foot wide pipeline corridor between the Bird Canyon Compressor Station and the Opal Gas Processing Plant (Section 27, T. 21 N., R. 114 W.) with an intermediate connection into the Pioneer Gas Processing Plant (Section 22, T. 21 N., R. 114 W.).

Of the 41.5 miles of proposed BCC between the adjacent Pinedale/Gobblers Knob and Paradise compressor stations and the Bird Canyon Compressor Station, approximately 20.2 miles would be located away from the boundary of the existing pipeline corridor. Approximately 18.8 miles of the 20.2 miles would be located on BLM administered federal lands.

Approximately 1.8 miles (0.8 mile of federal lands) of the proposed 300-foot wide, 62.1-mile long BFGC between Bird Canyon Compressor Station and the Blacks Fork Gas Plant would be located away from the boundary of the existing pipeline corridor. The location of the proposed 300-foot wide, 45.5-mile long OPC between the Bird Canyon Compressor Station and the Opal Gas Processing Plant would be adjacent to an existing corridor for its entire length.

Gas Sales Pipelines. RGS proposes to construct a 103.6-mile long, 30-inch diameter, natural gas pipeline (Rendezvous Phase 6 or R6 Pipeline) within the proposed BCC and BFGC to transport natural gas produced in the PAPA to gas processing plants. Segment 1 of the


Map 2.4-1
Proposed Corridors
and Gas Sales Pipelines
Pinedale
Pinedale/Gobblers Knob
Compressor Station
Boulder
Pinedale Anticline
Project Area
189
Paradise
Compressor Station
Alternative Corridor
Big Piney
351
Sublette County
Fremont County
Bird Canyon
Compressor Station
500-Foot Wide Bird Canyon Corridor (BCC)
Rendezvous 6 - Segment 1 Pipeline
Paradise to Bird Canyon Pipeline
Lincoln County
Sublette County
Sweetwater County
28
300-Foot Wide Opal Pioneer Corridor (OPC)
Opal Loop III Pipeline
Pioneer Plant
189
Opal Plant
300-Foot Wide Blacks Fork Granger Corridor (BFGC)
Rendezvous 6 - Segment 2 Pipeline
Sweetwater County
191
Kemmerer
30
Blacks Fork
Plant
Lincoln County
Uinta County
Granger
I80
Rock Springs
430
I80
Granger Plant
0 2 4 6 8 10 20
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

proposed R6 Pipeline (41.5 miles) would be located in the BCC, beginning at the Pinedale/Gobblers Knob Compressor Station and ending at the Bird Canyon Compressor Station (see description of the BCC above). Segment 2 of the proposed R6 Pipeline (62.1 miles) would begin at the Bird Canyon Compressor Station and end at the Blacks Fork Processing Plant (see description of the BFGC above). It is anticipated that the R6 Pipeline would be constructed during the summer and fall of either 2007 or 2008.

JGGC proposes to construct a 41.5-mile long, 36-inch natural gas pipeline (Paradise to Bird Canyon or PBC Pipeline) and a connecting 45.5-mile long, 30-inch pipeline (Opal Loop III Pipeline) to transport natural gas from the PAPA to gas processing plants (see Map 2.4-1). The PBC Pipeline would be located in the BCC and would parallel Segment 1 of the R6 Pipeline. The Opal Loop III Pipeline would be located in the OPC and would parallel the Bridger Pipeline that was constructed in 2006. It is anticipated that the PBC and Opal Loop III pipelines would be constructed after 2008.

The proposed R6 Pipeline (segments 1 and 2) and the PBC and Opal Loop III pipeline projects would include construction of ancillary facilities (valves, pigging equipment, side taps, and metering equipment). Table 2.4-3 shows the initial disturbance and the LOP disturbance for the pipelines. Each pipeline project would require a permanent right-of-way of 50 feet for operation and maintenance. The entire permanent right-of-way and the construction right-of-way would be revegetated. It is assumed that approximately 1.0 acre would be required for each pipeline for permanent ancillary aboveground facilities. Development Procedures for the proposed pipelines are included in Appendix D.

Table 2.4-3
Estimated Initial and Life-of-Project Disturbance
for Gas Sales Pipelines and Granger Gas Processing Plant

Component	Number or Miles	Total Disturbance (acres)	Life-of-Project Disturbance (acres)
30-inch Rendezvous (R6) Pipeline[1]	103.6 miles	1,506.9	1.0
R6 temporary extra work areas[2]	168 miles	23.3	0.0
R6 temporary extra work areas – HDDs[3]	4 sites	8.3	0.0
Subtotal		**1,538.5**	**1.0**
36-inch Paradise to Bird Canyon (PBC) Pipeline[1]	41.5 miles	603.6	1.0
PBC temporary extra work areas[2]		9.4	0.0
PBC temporary extra work areas – HDDs[3]	2 sites	4.2	0.0
Subtotal		**617.2**	**1.0**
30-inch Opal Loop III Pipeline[1]	45.5 miles	661.8	10
Opal Loop III temporary extra work areas[2]		10.5	0.0
Subtotal		**672.3**	**1.0**
Granger Gas Processing Plant	1 site	86.4	86.4
Total Sales Pipelines/Gas Plant	**1 site**	**2,914.4**	**89.40**

[1] Disturbance based on 120 foot construction right of way width.
[2] Temporary extra work areas are required for road, foreign line, historic trail and waterbody crossings.
[3] horizontal direction drill.

Gas Processing Plant Expansion. In conjunction with the proposed R6 Pipeline Project, RGS proposes to expand the existing 33.6-acre Granger Gas Processing Plant by 86.4 acres, for a total of 120 acres on BLM administered federal lands in Section 16, T. 18 N., R. 111 W. The purpose of the proposed expansion is to construct and operate additional natural gas processing facilities to sufficiently increase processing capacity for an anticipated increased input of 600 million standard cubic feet per day (MMSCF/D) of natural gas and crude petroleum. The current Granger Gas Processing Plant capacity is 600 MMSCF/D. The expansion would represent a 100 percent increase in treatment capacity. RGS and Mountain Gas Resources (MGR) anticipate constructing and operating new facilities, including compressors, gas processing equipment, liquids handling equipment, and supporting facilities, such as office space, parking, and fencing.

Although specific facility requirements, engineering, and designs are currently under development, maximum emissions have been estimated, and these values have been included in the air quality impact analysis for this Draft SEIS. RGS and MGR have assumed a maximum emissions scenario based on emissions from the current Granger Gas Processing Plant with a 600 MMSCF/D treatment configuration. The installation and operation of new, improved gas processing facilities should result in reduced emissions over the estimated amount.

Trunk Pipelines. QGM is proposing to install a 7.5-mile long, 30-inch gas pipeline from the Stewart Point Area to the 4-way area along existing rights-of way. They are also proposing to install two 7.8-mile long, 30-inch gas pipelines from the 4-way area to the Pinedale/Gobblers Knob Compressor Station. Initial disturbance requires 232.7 acres adjacent to, or within, existing rights-of-way for most of the route. QGM is also proposing to install a 22.8-mile long, 10-inch water line from the Stewart Point area to Highway 351. This requires an initial disturbance of 161.7 acres adjacent to, or within, existing rights-of-way for most of the route.

JGGC is proposing to install two 7.8-mile long 12-inch gas pipelines from the 4-way area to the Paradise Compressor Station, with an initial disturbance of 71.0 acres. This disturbance would occur adjacent to or within existing rights-of-way for most of the route.

Ancillary Facilities. Expansion of existing ancillary facilities, including compressor stations, central gathering facilities (CGFs), stabilizer sites, and water truck unloading facilities, are components that are common to all alternatives and are described below.

<u>Compressor Stations.</u> QGM and JGGC propose expansion of three compressor stations within the PAPA and one compressor station outside of the PAPA (Bird Canyon Compressor Station) through 2011 (see Table 2.4-4). The expansions include an additional 267,038 hp of compression, with additional LOP disturbance of 90 acres within the PAPA.

Table 2.4-4
Compressor Station Expansion Common to all Alternatives

Compressor Station Name	Field	Owner	Location	Additional Compression (hp)	Additional Disturbance (acres)
Pinedale/Gobblers Knob	PAPA	QGM	Section 2, T. 31 N., R. 109 W.	31,000 (2009)	20
Paradise	PAPA	JGCC	Section 2, T. 31 N., R. 109 W.	59,000 (2011) 125,000 (2011)	40
Falcon	PAPA	JGCC	Section 36, T. 30 N., R. 108 W.	7,366 (2011) 30,000 (2011)	30
Bird Canyon	SE of Jonah	JGCC	Section 34 T. 27 N., R. 111 W.	14,672 (2011)	0
Total				**267,038**	**90**

<u>Central Gathering Facilities</u> QGM is proposing six additional central gathering facilities (formerly known as central delivery points) to support their existing liquids gathering system

within the PAPA. Each CGF would require an additional 2 acres of disturbance for a LOP disturbance of 12 acres.

Stabilizer Facilities. QGM is proposing to expand the stabilizer site near the Pinedale/Gobblers Knob Compressor Station in support of their existing liquids gathering system. This expansion would require an additional LOP disturbance of 5 acres.

Water Truck Unloading Facilities. QGM is proposing to install truck unloading facilities near Highway 351 within the PAPA in support of their existing liquids gathering system. QGM's water trucking facility would require a LOP disturbance of 7 acres. QGM is proposing an additional truck unloading facility at the Falcon Compressor Station that would require an additional LOP disturbance of 15 acres.

Development of Deeper Formations. There is insufficient information to understand the level of development that may occur for recovery of natural gas from deeper formations. Future deep development would be allowed within the constraints of each alternative, or would undergo separate environmental analysis.

2.4.2.2 Alternative A (No Action Alternative)

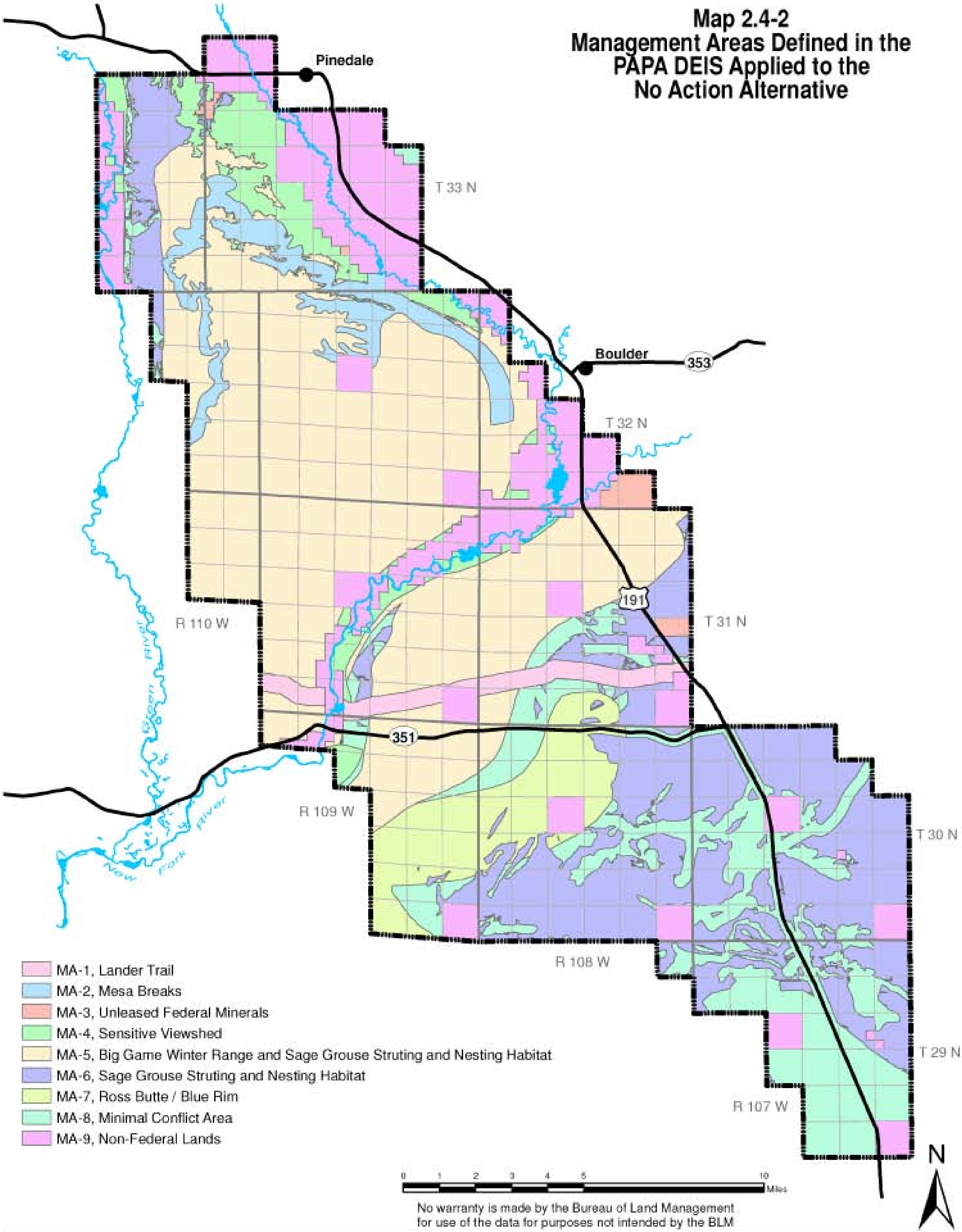
In many instances, the No Action Alternative means "no project" when a new project is proposed. The No Action Alternative can also mean "no change", in this case, from BLM's current management in the PAPA. In this Draft SEIS, the No Action Alternative has elements of both meanings; the Operators' Proposed Action would not occur and BLM would continue to manage natural gas development in the PAPA, based on all provisions of the PAPA ROD (BLM, 2000b) and subsequent Decision Records (BLM, 2004a, 2005a, 2005b, and 2005c). Both meanings are consistent with the DOI's (2004) NEPA Revised Implementing Procedures (in 516 DM §4.10(6)). Mitigation under the No Action Alternative would be the measures set forth in the PAPA ROD.

Continued Management Practices. The No Action Alternative is based on elements authorized by the PAPA ROD (BLM, 2000b) including:

- Approved Project Components (PAPA ROD Section 2),
- Administrative Requirements and Conditions of Approval (PAPA ROD Section 3), and
- Management Area Exploration and Development Restrictions and Limitations for Resource Protection (PAPA ROD Section 4).

Development in the PAPA beyond the limits and analysis thresholds specified in the PAPA ROD would require additional environmental review. Those thresholds are still in place in the No Action Alternative. The PAPA ROD did not specify the type or extent of the additional environmental review that would be required.

The PAPA ROD (BLM, 2000b) established thresholds on the number of producing well pads specified for each of nine MAs (see Map 2.4-2). There are timing and geographic restrictions on surface development in some MAs that would be carried through the No Action Alternative. For example, in MA 5 - *Big Game Winter Range and Sage Grouse Strutting and Nesting Habitat*, the PAPA ROD stipulated that drilling was not allowed on federal lands and minerals between November 15 and April 30, although BLM may grant exceptions to the restriction in consultation with WGFD (Section 1.3). Similarly, in MA 5 and MA 6 - *Sage Grouse Strutting and Nesting Habitat*, additional seasonal restrictions were stipulated to protect greater sage-grouse seasonally-used habitats, applicable on a site-specific basis, but which could limit drilling activities between March 1 and July 31.


Map 2.4-2
Management Areas Defined in the
PAPA DEIS Applied to the
No Action Alternative
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
MA-1, Lander Trail
MA-2, Mesa Breaks
MA-3, Unleased Federal Minerals
MA-4, Sensitive Viewshed
MA-5, Big Game Winter Range and Sage Grouse Struting and Nesting Habitat
MA-6, Sage Grouse Struting and Nesting Habitat
MA-7, Ross Butte / Blue Rim
MA-8, Minimal Conflict Area
MA-9, Non-Federal Lands
0 1 2 3 4 5 10
Miles
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for use of the data for purposes not intended by the BLM
N

The operators provided information on how they would further develop the PAPA under the No Action Alternative (current management practices) while adhering to seasonal stipulations for wildlife. Using their projections, limitations to wellfield development as set forth in the PAPA ROD (BLM, 2000b), would be reached as follows:

- 212 well pad limit in MA 5 would be reached in 2009;
- Approximately 276.0 miles of road would be reached in 2011.
- 68 well pad limit in MA 7 would be reached in 2011;
- 28 well pad limit in MA 4 would be reached in 2013; and
- 700 well pad limit in the entire PAPA would be reached in 2014.

The air quality impact analysis conducted for the PAPA DEIS (BLM, 1999a) included 700 producing well locations, 900 wells drilled, and up to eight drilling rigs operating in the PAPA. It further assumed approximately 1,000 horsepower per drilling rig. The PAPA ROD states

> *"If activity and corresponding emission assumptions and/or impacts exceed those identified in the Pinedale Anticline EIS (376.59 tons/year of NO_x emission from compressors or 693.5 tons/year NO_x emissions from the combination of construction/drilling, well production, and compression), the BLM, in cooperation and consultation with Wyoming Department of Environmental Quality-Air Quality Division (DEQ-AQD), EPA Region VIII, USDA-Forest Service, and other affected agencies, will undertake additional cumulative air quality environmental review as required by CEQ regulations 40 CFR 1502.9(c)(1)(ii)."*

Since the PAPA ROD (BLM, 2000b) was issued, natural gas development within the PAPA has occurred at a pace greater than was analyzed in the PAPA EIS. Assumptions of drill rig emissions and NO_x emissions from the combination of construction/drilling, well production, and compression have been exceeded. The air quality impact analysis conducted for this Draft SEIS will serve as the additional environmental review referenced above, as well as to analyze the current proposal.

In the No Action Alternative, air quality impacts were modeled for the year 2007 to show the increase in impacts beyond that predicted in the PAPA DEIS (BLM, 1999a). It is estimated that there will be up to 900 producing wells in 2007. The 2007 air quality impact analysis discloses impacts for current allowable development in the PAPA under the No Action Alternative (before reaching surface disturbance limits). The 2007 air quality impact analysis assumed approximately 900 producing wells, 43 drilling rigs operating in the summer, and 30 drilling rigs operating in the winter, with approximately 3,875 hp for each drilling rig.

Even though the limit of 212 producing well pads in MA 5 authorized in the PAPA ROD would be attained in 2009, the No Action Alternative is analyzed through 2011 to allow comparison between all alternatives (No Action Alternative, Proposed Action Alternative, and Alternative C) in 2011 for most resources. The No Action Alternative, through 2011, includes approximately 1,800 producing wells.

Project Components. The project components in the No Action Alternative include well pads, roads, and gathering (gas and liquid) pipelines. Transportation corridors, gas sales pipelines, the Granger Gas Processing Plant expansion, trunk pipelines and ancillary facilities are also included in the No Action Alternative. These components are required for continued transport of natural gas and liquids from the PAPA as development carries forward under the PAPA ROD (BLM, 2000b), and are detailed in Section 2.4.2.1 – Components Common to All Alternatives. Projected disturbance was determined from responses provided by the Operators regarding how they would continue to develop natural gas resources under the PAPA ROD and subsequent Decision Records (BLM, 2004a, 2005a, 2005b, and 2005c).

The proposed project components and estimated disturbance for the No Action Alternative through 2011 are provided in Table 2.4-5. Initial disturbance is defined as the amount of acreage that is disturbed at the time of construction. Initial disturbance for the No Action Alternative for well pads, roads, and gathering pipelines is estimated to be 3,890.3 acres. LOP disturbance for the same components is expected to be 1,179.5 aces. LOP disturbance is defined as the amount of disturbance remaining once reclamation has occurred. For example, it is assumed that well pad reclamation would achieve 40 percent of the initial disturbance when all development activities have been completed. Likewise, it is assumed that 20 percent of the initial disturbance for roads would be reclaimed while 80 percent of the disturbance would remain to support continued operations.

Table 2.4-5
Estimated Initial and Life-of-Project
Disturbance under the No Action Alternative through 2011

Component	Number or Miles	Initial Disturbance (acres)	Life-of-Project Disturbance (acres)
Well Pads, Roads and Gathering Pipelines			
Well Pads[1]	245 pads	2,559.0	1,023.6
Local and Resource Roads[2]	108.0 miles	654.8	194.9
Gas Gathering Pipelines[3]	105.6 miles	640.4	0.0
Liquid gathering pipelines – QGM[4]	6.0 miles	36.1	0.0
Subtotal		**3,890.3**	**1,179.5**
Trunk Pipelines and Ancillary Facilities			
30-inch Mesa Loop Lines[5]	15.3 miles	232.5	2.00
10-inch water line[6]	22.8 miles	161.7	2.00
12-inch gas pipelines[7]	7.8 miles	71.0	2.00
Compressor Sites (expansion)	3 sites	90.0	90.00
Central Gathering Facilities	6 sites	12.0	12.00
Water Trucking Facility	1 site	7.0	7.00
Falcon Truck Unloading	1 site	15.0	15.00
Expand Stabilizer Site	1 site	5.0	5.00
Subtotal		**594.2**	**135.00**
Total Wellfield Components		**4,484.5**	**1,314.5**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, estimate for miles of proposed roads based on factors determined from existing roads. LOP disturbance assume 20 percent reclamation of roads.
[3] Estimate for miles of proposed gas gathering pipelines based on factors determined from existing roads.
[4] Estimate for miles of proposed liquid gathering pipelines are based on data provided by the Operators.
[5] Disturbance based on 200-foot construction right-of-way width. Includes one 30-inch gas pipeline from Stewart Point area to 4-way area (7.5 miles) and two 30-inch gas pipelines from 4-way area to Pinedale/Gobblers Knob Compressor Station (7.8 miles).
[6] Disturbance based on 50-foot construction right-of-way width from Stewart Point area to Highway 351.
[7] Disturbance based 50-foot construction right-of-way width. Includes two 12-inch gas pipelines from 4-way area to Paradise Compressor Station.

Nearly all initial disturbance for pipelines would be reclaimed, leaving almost no LOP disturbance. In contrast, for other ancillary facilities such as compressor station expansion, central gathering facilities, etc., the LOP disturbance would be the same as the initial disturbance, i.e., none of the disturbance would be reclaimed until the facility is no longer in use.

Wells and Drilling Rigs. The estimated number of drilling rigs operating and wells drilled per year under the No Action Alternative is provided in Table 2.4-6. More rigs would be operating in the summer than in the winter under the No Action Alternative because seasonal wildlife restrictions would apply in big game crucial ranges.

Table 2.4-6
Proposed Wells and Drilling Rigs by Year under the No Action Alternative

Year	Wells	Drilling Rigs	
		Summer	Winter
2007	231	43	30
2008	235	43	30
2009	236	43	30
2010	217	40	27
2011	220	40	27
Total	**1,139**		

Well Pads. The Operators have proposed additional well pads within each MA. The additional pads have been added to the current number of well pads in the PAPA (Table 2.4-7). From the progression in Table 2.4-7, it is evident that the threshold of 212 pads in MA 5 would be reached in 2009. Likewise, the threshold of 68 pads in MA 7 would be reached in 2011, assuming all well pads support producing wells.

Table 2.4-7
Total Number of Well Pads Within each Management Area that have been Proposed by the Operators under the No Action Alternative

	Total Well Pads in Year – No Action Alternative											
	MA 4 Limit 28		MA 5 Limit 212		MA 6 Limit 183		MA 7 Limit 68		MA 8 Limit 168		MA 9 Limit 200	
Year	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total
2005	5	5	113	113	43	43	25	25	31	31	49	49
2006	0	5	16	129	2	45	5	30	1	32	2	51
2007	4	9	43	172	8	53	16	46	12	44	4	55
2008	4	13	21	193	9	62	6	52	9	53	4	59
2009	4	17	19	212	9	71	6	58	7	60	6	65
2010	4	21	0	212	8	79	6	64	7	67	2	67
2011	3	24	0	212	8	87	4	68	7	74	0	67

Under the No Action Alternative, when the threshold number of producing wells has been reached in a specific MA, additional development would be halted until additional environmental analyses are complete or until a well on a pad is no longer producing gas, is plugged, and the pad area is reclaimed for one full growing season. The reclaimed pad would be credited back to the MA and a new well pad could be developed, as long as the approved threshold is not exceeded.

Initial disturbance estimates for 245 new well pads by 2011 is 2,559.0 acres, with a LOP estimated disturbance of 1,023.6 acres. Reclamation of well pads would be similar to current reclamation practices.

Roads and Gathering Pipelines. Under the No Action Alternative, it is assumed that there would be no additional construction of collector roads within the PAPA. There would be approximately 108.0 miles of local and resource roads constructed in the PAPA by 2011, for an initial disturbance of 654.8 acres and a LOP disturbance of 194.9 acres, assuming that 20 percent of the initial road disturbance is reclaimed after construction (see Table 2.4-5). There would also be approximately 105.6 miles of gas gathering pipelines and 6.0 miles of liquid gathering pipelines, for an initial disturbance of 640.4 and 36.1 acres, respectively. There is no

LOP disturbance associated with construction of gathering pipelines because the entire disturbance is reclaimed after construction.

2.4.2.3 Alternative B (The Proposed Action)

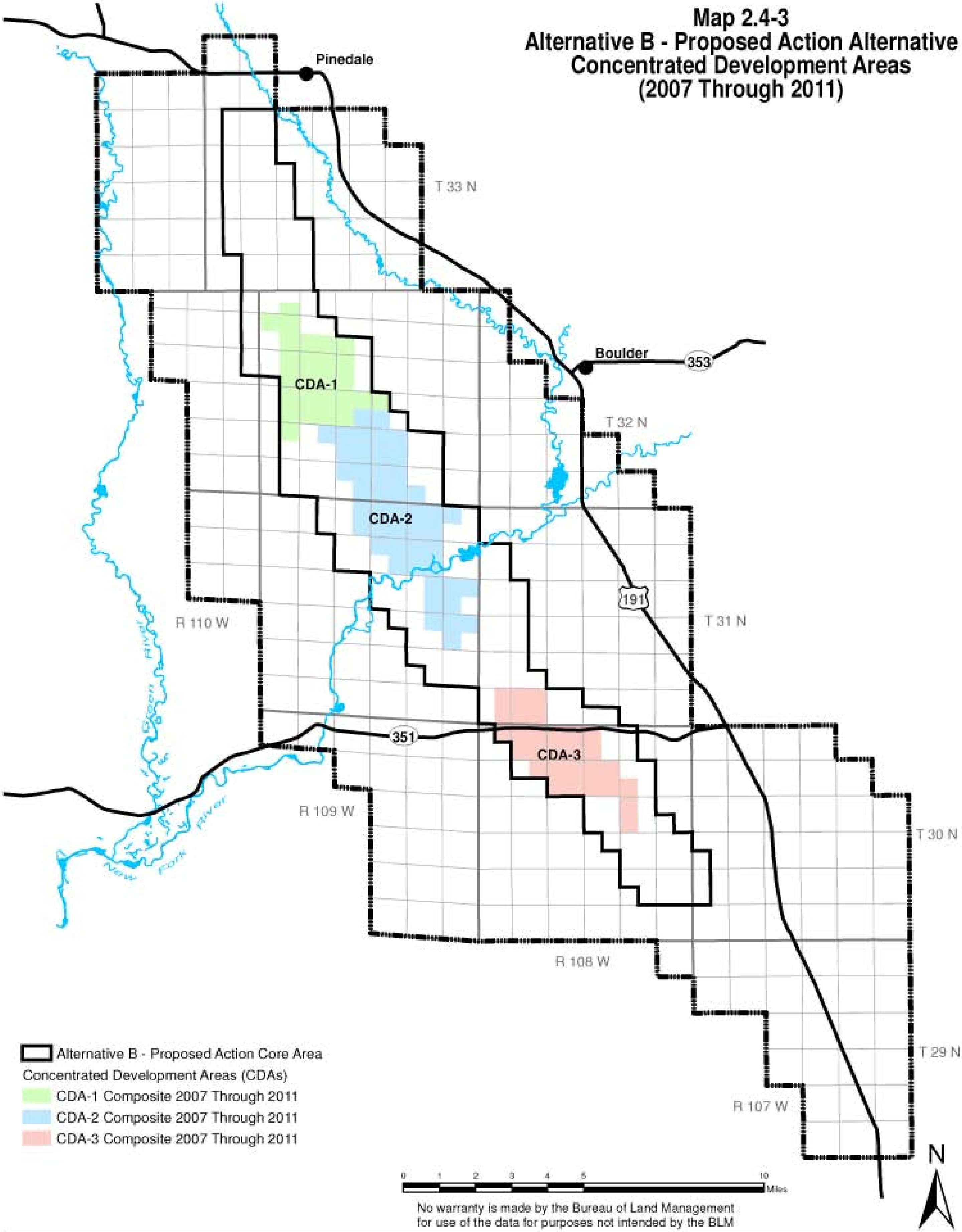
The Operators have voluntarily proposed a long-term development plan for the PAPA referred to as "Concentrated Development" to recover the estimated 20 to 25 TCF of natural gas in the PAPA. The Operators have defined a "core area" within the PAPA, mostly along the Anticline Crest, where the majority of development activity would take place (see Map 2.4-3). The core area encompasses 43,623.5 acres (68.1 square miles), or 22 percent of the PAPA. Within the core area, the Operators have defined three Concentrated Development Areas (CDAs) that would move slowly as pads are drilled out. Each of the three individual CDAs would not exceed 8 square miles; however, they would be tightly grouped, with the combined area of the three not exceeding 19 square miles. The Operators have proposed the CDAs and their movement to leave large, contiguous blocks of land and corridors available for wildlife without active natural gas development activities. The Operators have provided examples of CDAs and how they could move from 2007 through 2011. Map 2.4-3 shows a composite of the three CDAs for 2007 through 2011. In other words, the three CDAs would most likely be in these three areas over the first 5 years, while adhering to the size restrictions stated above. Operators would attempt to fully develop each multi-well pad to the approved bottom-hole spacing before moving drilling rigs off of pads. It is estimated that rigs would move to a new pad an average of once per year. Pad reclamation would proceed as soon as practical when the last well on the pad is completed, reducing net disturbance as development proceeds. Interim reclamation would occur for pads not scheduled for development activity within 2 years.

The Operators are proposing production initiatives that would lower human presence year-round and throughout the production phase. One of these initiatives is the installation of a liquids gathering system in the central and southern portions of the PAPA, which would nearly eliminate trucking of produced water and condensate (see Appendix C for further description of the liquids gathering system). It would also allow for removal of some storage tanks on well pads that currently store condensate and produced water. The Operators propose to expand the use of computer assisted operations on multi-well pads to reduce the number of daily visits by production operations personnel.

To provide more predictability during the development phase, the Operators are proposing to develop a 10-year rolling forecast or development plan working with BLM and WGFD. Each year, the Operators would review these plans with BLM and WGFD to seek improvements to the development plan in an attempt to further reduce impacts.

The Operators are proposing to conduct year-round drilling, completions, production, and construct ancillary facilities while utilizing multi-well pad development and directional drilling within the three CDAs. This would require temporary relaxation of stipulations where the CDA is active within big game crucial winter range and other sensitive wildlife habitats during the seasonally restricted periods. The Operators have provided plans which are included in Appendix C including a Transportation Plan, Reclamation Plan, Hazardous Materials Summary, and a Wildlife and Habitat Mitigation Plan.

The northern-most portion of the PAPA contains mostly a single operator's contiguous leases, unlike the central and southern portion, where many of the leases are in a checkerboard ownership pattern. CDA-1 (see Map 2.4-3) would be located in the north within the core area of mostly single operator contiguous leases. Under the Proposed Action, CDA-1 would begin at the southern end of the mostly single operator leasehold and slowly move north.


Map 2.4-3
Alternative B - Proposed Action Alternative
Concentrated Development Areas
(2007 Through 2011)
Pinedale
Boulder
353
191
351
CDA-1
CDA-2
CDA-3
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Alternative B - Proposed Action Core Area
Concentrated Development Areas (CDAs)
CDA-1 Composite 2007 Through 2011
CDA-2 Composite 2007 Through 2011
CDA-3 Composite 2007 Through 2011
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

The middle and southern portion of the PAPA contain leases that are operated primarily in a checkerboard ownership pattern within the core area. Under the Proposed Action, the Operators propose to work together to develop their leases within CDA-2 and CDA-3. CDA-2 would initially be located at the southern boundary of CDA-1, essentially further concentrating the development. As leases are drilled out, CDA-2 would slowly move to the south. The Operators would work together to develop CDA-3 in the southern portion of the PAPA (see Map 2.4-3). CDA-3 would move to the south at approximately the same pace as CDA-2.

The Operators are proposing to drill delineation wells within the first 5 years to assess production capabilities and ultimate well density required to develop their leases, both within and outside of the core area. A portion of the delineation wells would be drilled on well pads with existing producing wells. Where possible, the delineation wells would be drilled in accordance with all seasonal stipulations. There may be some instances in the first 5 years where delineation wells must be drilled outside of the CDAs and outside of the core area during the seasonally restricted periods. This would require an exception from BLM for temporary relaxation of seasonal stipulations. Once the 5-year delineation period is over, all drilling in all seasons would be restricted to the three CDAs. Operators are committing to interim reclamation on pads not scheduled for development under the CDA plan within 2 years. The pads would be reclaimed to the size required for safe production operations.

All development drilling would be on consolidated pads from which multiple wells would be drilled. Some delineation wells are planned to be drilled on new pads with one to three wells on the pad while other delineation wells would be drilled from existing producing pads. Small delineation pads would be expanded to accommodate additional wells (when they become part of a CDA), if commercially successful, or would be reclaimed if the wells are not commercially successful. Expansion of existing producing pads, by up to 21 acres, would be necessary to accommodate additional drilling.

Additional production from leases that have existing liquids gathering systems would be joined to the existing system. Operators are proposing to install additional liquids gathering systems (within 2 years of issuance of the ROD) to transport condensate and produced water from their leases to central gathering facilities. Production from delineation wells would be joined to the liquids gathering system, where possible, and placed within existing rights-of-way.

Construction of ancillary facilities (compressor station expansions, central gathering facilities, and gathering and sales pipelines) would take place both within and outside the CDAs. Topsoil removal for pad and/or road construction, would not be conducted during frozen soil conditions. Development procedures for wellfield activities are provided in Appendix C.

As part of the Proposed Action Alternative, the Operators plan to implement Tier 2 equivalent emissions technology on all of their new drilling rig engines within 2 years after issuance of the ROD. Some drilling rig engines would continue to have higher emissions (i.e., Tier 0 and Tier 1); however, these drilling rigs would be phased out after 2010. Of the 48 drilling rigs proposed by the end of 2009, 29 would have Tier 2 equivalent emission levels, 15 drilling rigs would have Tier 1 equivalent emission levels, and 4 drilling rigs would have Tier 0 equivalent emission levels.

Project Components. Estimated disturbance for each component under the Proposed Action Alternative is provided in Tables 2.4-8 and 2.4-9 through 2011 and 2023, respectively. Although the Proposed Action includes long-term development through 2023, disturbance is also shown for 2011 to provide a comparison to the No Action Alternative, which is only carried forward through 2011. Estimates are provided for initial disturbance and LOP disturbance for each project component.

In their long-term development plan, the Operators provided estimates for the number of new and expanded pads by year, and the estimated disturbance associated with well pads through 2023. Estimates for disturbance associated with roads and gas gathering pipelines were determined using factors for existing gas gathering pipelines and roads per well pad. Disturbance estimates for expansion of the existing liquids gathering system, construction of the proposed liquids gathering system, and for construction of trunk pipelines and ancillary facilities, were provided by the Operators. With those estimates, the initial disturbance under the Proposed Action Alternative is 6,845.0 acres through 2011, and 12,278.4 acres through 2023 (see Tables 2.4-8 and 2.4-9).

Table 2.4-8
Estimated Initial and Life-of-Project Disturbance under the Proposed Action Alternative through 2011

Component	Number or Miles	Initial Disturbance (acres)	Life-of-Project Disturbance (acres)
Well Pads, Roads and Gas Gathering Pipelines			
Well Pads[1]	179 pads	3,427.0	1,370.8
Local and Resource Roads[2]	88.7 miles	537.5	430.0
Gas Gathering Pipelines[3]	93.1 miles	524.2	0.00
Liquid Gathering Pipelines[4]	235.8 miles	1,428.9	
Subtotal		**5,917.6**	**1,800.8**
Trunk Pipelines and Ancillary Facilities			
30-inch Mesa Loop Lines[5]	15.3 miles	232.7	2.0
10-inch water line[6]	22.8 miles	161.7	2.0
12-inch gas pipelines[7]	7.8 miles	71.0	2.0
Trunk lines – liquid gathering[8]	18 miles	164.0	0.0
Water Redistribution[4]	6 miles	36.0	0.0
Pipeline Interconnection	0.5 mile	3.0	0.0
Compressor Sites (expansion)	3 sites	90.0	90.0
Central Gathering Facilities	9 sites	90.0	90.0
Central Gathering Facilities	6 sites	12.0	12.0
Falcon Stabilizer Facility	1 site	20.0	20.0
Water Trucking Facility	1 site	20.0	20.0
Water Trucking Facility	1 site	7.0	7.0
Falcon Truck Unloading	1 site	15.0	15.0
Expand Stabilizer Site	1 site	5.0	5.0
Subtotal		**927.4**	**265.0**
Total Wellfield Components		**6,845.0**	**2,065.8**

1 Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
2 Assumes no new collector roads would be built within the PAPA, estimate for miles of proposed roads based on factors determined from existing roads. LOP disturbance assume 20 percent reclamation of roads.
3 Estimate for miles of proposed gas gathering pipelines based on factors determined from existing roads.
4 Estimate for miles of proposed liquid gathering pipelines are based on data provided by the Operators.
5 Disturbance based on 200-foot construction right-of-way width. Includes one 30-inch gas pipeline from Stewart Point area to 4-way area (7.5 miles) and two 30-inch gas pipelines from 4-way area to Pinedale Compressor Station (7.8 miles).
6 Disturbance based on 50-foot construction right-of-way width from Stewart Point area to Highway 351.
7 Disturbance based 50-foot construction right-of-way width. Includes one 12-inch crude petroleum pipeline and one water pipeline from 4-way area to Paradise Compressor Station.
8 Disturbance based on 75-foot construction right-of-way width.

Table 2.4-9
Estimated Initial and Life-of-Project
Disturbance under the Proposed Action Alternative through 2023

Component	Number or miles	Total Disturbance (acres)	Life-of-Project Disturbance (acres)
Well Pads, Roads and Gas Gathering Pipelines			
Well Pads[1]	250 pads	8,112.0	3,244.8
Local and Resource Roads[2]	120.8 miles	729.4	583.5
Gas Gathering Pipelines[3]	118.6 miles	721.6	0.0
Liquids Gathering Pipelines	295.0 miles	1,788.0	
Subtotal		**11,351.0**	**3,828.3**
Trunk Pipelines and Ancillary Facilities[5]		927.4	265.0
Total Wellfield Components		**12,278.4**	**4,093.3**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, estimate for miles of proposed roads based on factors determined from existing roads. LOP disturbance assume 20 percent reclamation of roads.
[3] Estimate for miles of proposed gas gathering pipelines based on factors determined from existing roads.
[4] Estimate for miles of proposed liquid gathering pipelines are based on data provided by the Operators.
[5] Detail for trunk pipelines and ancillary facilities is described in Table 2.4-8 for the Proposed Action Alternative 2011.

Wells and Drilling Rigs. The Operators estimate that all surface disturbance (roads, gathering pipelines and well pad construction) would be complete by 2023, with drilling continuing through 2025. Table 2.4-10 shows the estimated number of wells drilled per year and the estimated number of drilling rigs that would be operating in the PAPA each year. At the end of 2011, there would be approximately 1,453 additional wells drilled in the PAPA under the Proposed Action Alternative. At the end of 2023, there would be approximately 4,399 wells drilled. Table 2.4-10 shows that there is an initial increase in estimated drilling rigs (from the current level of 33 rigs) in the PAPA, peaking in 2009 with 48 rigs. The estimated rig number stabilizes at 45 before it begins to decline as Operators have drilled out their leases. The Operators are proposing that the most wells drilled in any one year would be about 305. The number of wells drilled per year also begins to decline as leases are drilled out. The number of proposed wells is an estimate based on estimated proposed rigs and current drilling.

Well Pads. The Operators are proposing development that utilizes consolidated well pads on a wide-scale throughout the PAPA. Therefore, the sequence described in the PAPA DEIS (BLM, 1999a) is no longer applicable. The majority of the new wells would be drilled from existing pads that may require expansion by up to 21 acres but no new access roads, gathering pipelines and water wells would be required for the existing pads. Some wells would be drilled from new pads that may become expansion pads. These new pads would require a new access road, gathering pipelines and a water well supply well if the wells are successful.

Operators are proposing to drill up to 4,399 additional wells in the PAPA between 2007 and 2025. It is estimated that to drill these wells, 250 new well pads would be required (179 new pads by 2011). In all, the total number of well pads in the PAPA in 2024 is expected to be 598, the sum of 322 existing pads in 2005, 26 pads in 2006, and 250 pads in the Proposed Action.

Table 2.4-10
Estimated Wells and Drilling Rigs by Year
for the Proposed Action Alternative Through 2025

Year	Wells	Drilling Rigs
2007	268	35
2008	299	45
2009	305	48
2010	291	45
2011	290	45
2012	289	45
2013	288	45
2014	287	45
2015	287	45
2016	286	45
2017	282	44
2018	279	43
2019	213	35
2020	187	28
2021	177	26
2022	143	21
2023	112	19
2024	107	16
2025	9	3
Total	**4,399**	

Initial disturbance estimates for 179 well pads through 2011 is 3,427.0 acres, with a LOP disturbance estimate of 1,370.8 acres (Table 2.4-8). By 2023, the initial disturbance estimate for 250 well pads is 8,112.0 acres, with a LOP disturbance estimate of 3,244.8 acres (Table 2.4-9). The Operators have prepared a Reclamation Plan (Appendix C). Under the Plan, initial disturbance associated with well pads would be reclaimed to a LOP disturbance of 40 percent (i.e., only 40 percent of the initial disturbance on a pad would remain, once development is complete).

Roads and Gathering Pipelines. Under the Proposed Action Alternative, it is assumed that there would be no additional construction of collector roads within the PAPA. There would be approximately 88.7 miles of local and resource roads constructed in the PAPA by 2011, for an initial disturbance of 537.5 acres, and a LOP disturbance of 430.0 acres, assuming that 20 percent of the initial road disturbance would be reclaimed within one growing season after construction (see Table 2.4-8). There would also be approximately 118.6 miles of gas gathering pipelines and 295.0 miles of liquid gathering pipelines by 2023, for an initial disturbance of 721.6 acres and 1,788.0 acres, respectively (see Table 2.4-9). There is no LOP disturbance associated with construction of gathering pipelines because the entire disturbance is reclaimed after construction.

Currently, condensate and produced water are trucked from the central and southern portions of the PAPA. The Operators are proposing to install an additional 235.8 miles of liquids gathering pipelines by 2011, which would be 295.0 miles by 2023. The gathering system would disturb 1,428.9 acres and 1,788.0 acres in 2011 and 2023, respectively. The liquids gathering pipelines would be connected to the pipeline that delivers crude petroleum to the processing facilities. Produced water would be collected at truck unloading facilities and transported to various commercial water disposal locations.

Trunk Pipelines. In addition to the trunk pipelines described in Section 2.4.2.1 (Components Common to All Alternatives), the Operators are proposing to install an 18-mile long liquids trunk line, 6 miles of water redistribution pipelines, and a 0.5-mile pipeline interconnection in support of the new liquids gathering systems. Total estimated initial disturbance for these pipelines is 203.0 acres.

Ancillary Facilities. Several ancillary facilities, including expansion of existing facilities, are proposed within the PAPA.

Compressor Stations. In addition to the compression included in Section 2.4.2.1 (Components Common to All Alternatives), QGM is proposing to install an additional 15,500 hp of compression at the Pinedale/Gobblers Knob Compressor Station in 2015. Combined, the Proposed Action includes 282,538 hp of new compression, all to be located at existing compressor stations.

Central Gathering Facilities As part of the new gathering system, the Operators are proposing to construct nine CGFs requiring 10 acres each, for a total initial and LOP disturbance of 90 acres.

Stabilizer Facilities. The Operators are proposing to build a stabilizer facility at the Falcon Compressor Station that would require an additional 20 acres of LOP disturbance. The purpose of the stabilizer is to make a “stable” product (crude petroleum) that can be metered, and it then would be sent to the pipeline for transport off the PAPA.

Water Truck Unloading Facilities. In addition to facilities described in Section 2.4.2.1 (Components Common to All Alternatives) and in support of the new gathering system, the Operators are proposing to install truck unloading facilities near Highway 351. This would require an initial and LOP disturbance of 20 acres.

Options to eventually pipe, rather than truck, the produced water collected at the truck unloading facilities are in the early preliminary investigation phases. One option would be to build pipeline spurs running from the truck unloading facility to the nearby evaporation pit facilities operated by Anticline Disposal. Another option would be to construct a water disposal pipeline running from the truck unloading facility to the Big Piney Water Disposal Facility located approximately 35 miles southwest of the PAPA.

2.4.2.4 Alternative C

Alternative C is similar to the Proposed Action in number of wells, drilling rigs, number of new well pads, and includes:

- all project components described for the Proposed Action;
- the transportation corridors, gas sales pipelines and Granger Gas Processing Plant expansion;
- the development procedures for wellfield activities (Appendix C) and pipeline construction (Appendix D);
- a total of 4,399 wells drilled by the end of 2023;
- a peak of 48 drillings rigs operating in the PAPA, leveling off to 45 rigs after 2010;
- most drilling rigs with Tier 2 equivalent emissions by 2010; and
- installation of liquids gathering system in the southern portion of the PAPA.

Although Alternative C is similar to the Proposed Action in that it includes the same project components, it is different from the Proposed Action, geographically. That is, rather than only specifying certain areas of development where year-round drilling could occur, Alternative C specifies areas where year-round drilling would not occur. It includes a core area boundary that is different from the Proposed Action. The overall objective of Alternative C is to control spatial disturbance over time maximizing development in some areas while minimizing development in other areas, especially in portions of big game crucial winter ranges. BLM has developed Performance-Based Objectives, which would apply to Alternative C (Appendix E). For each objective, the performance, or outcome, is the basis for judging the effectiveness of whatever measure is actually implemented. If the outcome is achieved, then the objective is met.

The Proposed Action Alternative Core Area was defined by the Operators and was based on the success of development to date and projections for success in future development. The Alternative C Core Area is based on BLM's Reservoir Management Group (RMG) projections for potential development in the PAPA (see Map 2.4-4). The USGS (Crockett et al., 2003) has defined "Very High Potential Areas", "High Potential Areas", "Moderate Potential Areas" and "Low Potential Areas" for development of the Pinedale Anticline as follows:

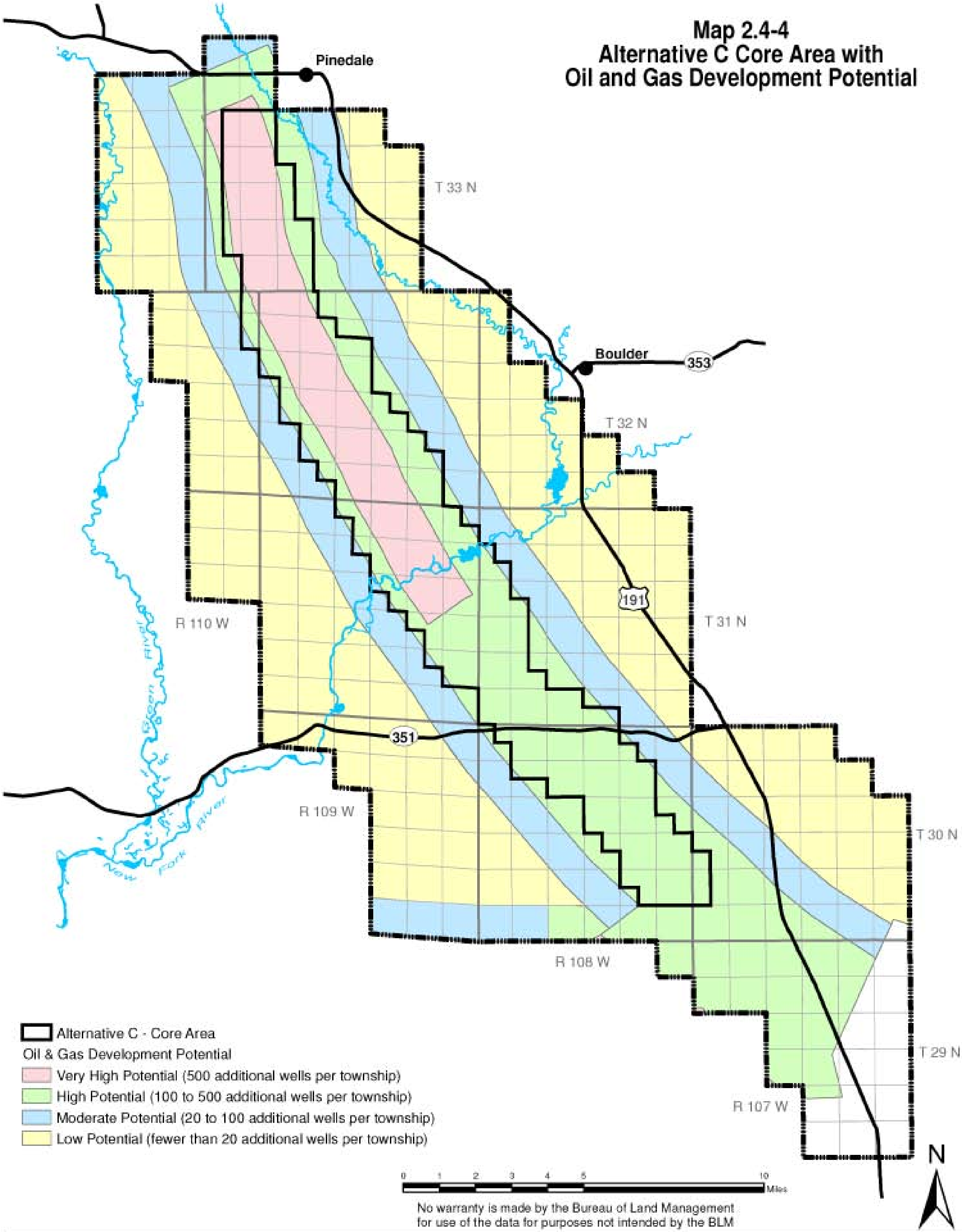
- Very High Potential Area – defined as a 1.5-mile wide band lying on the Pinedale Anticline axis including all acres 1 mile east and 0.5 mile west of the anticlinal axis with a northwest and southeast limit. This area would include over 500 additional wells per township (approximately 36 square miles).
- High Potential Area – defined as a 3-mile wide band lying on the Pinedale Anticline axis including all acres 2 miles east and 1 mile west of the anticlinal axis with a northwest and southeast limit. This area would include 100 to 500 additional wells per township.
- Moderate Potential Area – defined as a 5-mile wide band lying on the Pinedale Anticline axis including all acres 3 miles east and 2 miles west of the anticlinal axis with a northwest and southeast limit. This area would include 20 to 100 additional wells.
- Low Potential Area – includes all other areas in the PAPA and beyond. This area would include fewer than 20 additional wells per township.

The Very High, High, Moderate, and Low potential areas are shown in Map 2.4-4. For Alternative C, the core area is defined as the Very High and High potential areas. Approximately 39,678.3 acres (62.0 square miles) are included in the Alternative C Core Area. This area is 20 percent of the PAPA and is smaller than the Proposed Action Alternative Core Area (22 percent of the PAPA).

Alternative C includes five Development Areas (DAs) where there would be temporary relaxation of seasonal wildlife stipulations (see Map 2.4-5). For year-round drilling operations, In all development areas except for DA-5, Operators would be required to fully develop each existing and/or new well pad in one continuous time span for as long as necessary to drill and complete all wells on the pad. Once an Operator has determined that a well pad has been fully developed, they would not be allowed to reinitiate development on the well pad. Once a well pad has been fully developed, full site restoration and reclamation would begin as soon as the ground is not frozen and would be completed before the onset of winter. These elements of Alternative C would not apply in DA-5 because Operators would not be able to fully develop well pads due to timing and geographical constraints related to greater sage-grouse breeding and nesting habitats.

Seasonal wildlife stipulations would apply to new surface disturbing activities in all areas outside of the Alternative C Core Area. Development activities would be allowed in all DAs and outside of the Core Area at any time under the restriction of seasonal timing stipulations. Under Alternative C, the need for exceptions to seasonal wildlife stipulations would be greatly reduced.

In all areas of the PAPA, Operators would be required to expand existing well pads before constructing new well pads. Operators would be allowed to develop from all existing well pads


Map 2.4-4
Alternative C Core Area with
Oil and Gas Development Potential
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Alternative C - Core Area
Oil & Gas Development Potential
Very High Potential (500 additional wells per township)
High Potential (100 to 500 additional wells per township)
Moderate Potential (20 to 100 additional wells per township)
Low Potential (fewer than 20 additional wells per township)
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
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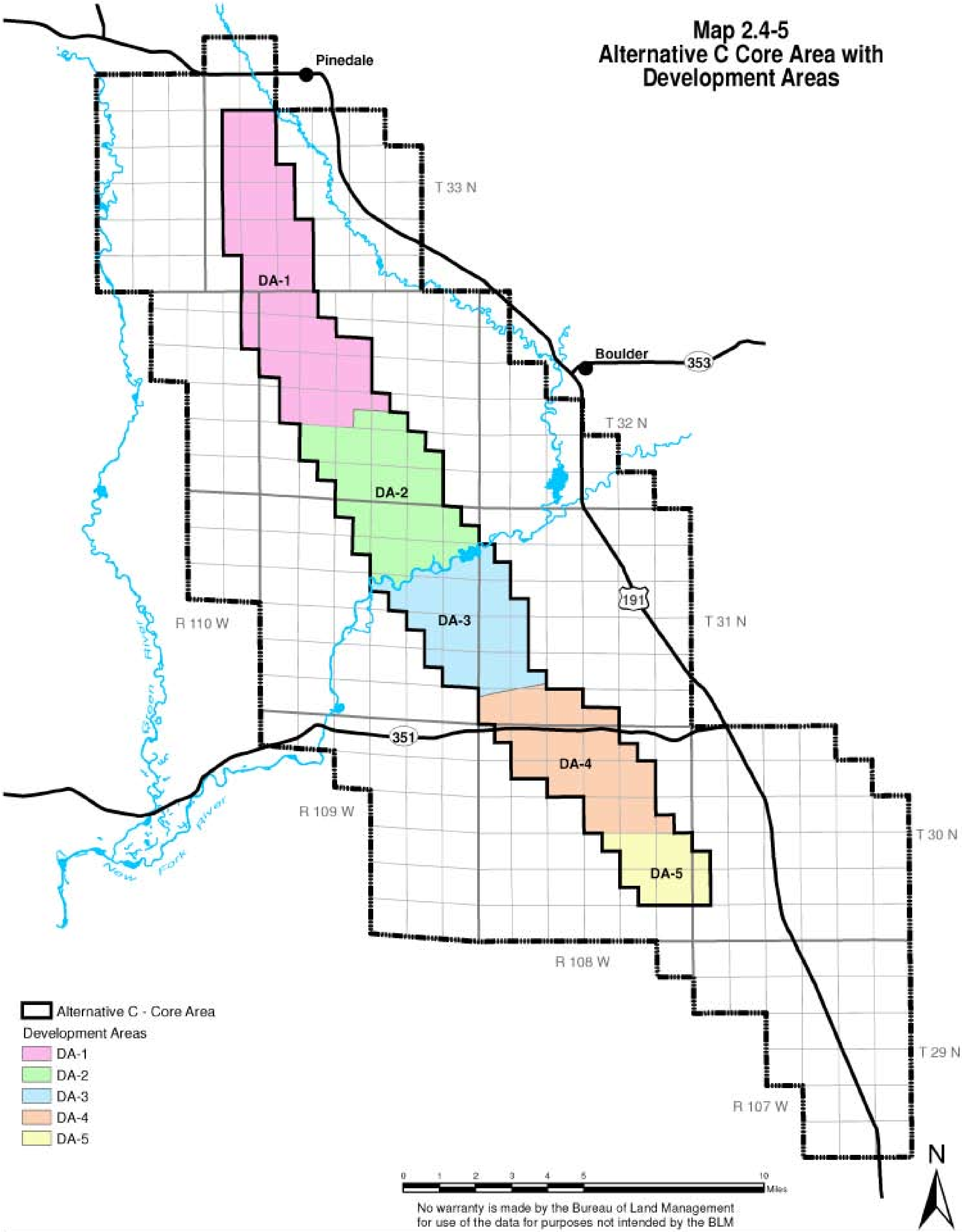

Map 2.4-5
Alternative C Core Area with Development Areas
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
DA-1
DA-2
DA-3
DA-4
DA-5
Alternative C - Core Area
Development Areas
DA-1
DA-2
DA-3
DA-4
DA-5
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

within a quarter-section. If there are no existing well pads within a quarter-section, Operators would be allowed to develop one new well pad. Additional well pads in the quarter-section may be considered by BLM on case by case basis. Most new producing wells would be required to be connected to a liquids gathering system. Outside of the seasonally restricted periods, Operators would not be required to completely develop pads and could return to the pad in following years.

Operators would be required to comply with BLM's Performance Based Objectives that would apply to Alternative C (Appendix E) to fully stabilize sites immediately. Each DA has specific requirements for development as follows:

- DA-1 – this is the northern-most DA, includes mostly contiguous leaseholds, is entirely within big game crucial winter ranges (see Map 2.4-6), and overlaps portions of 2-mile buffers associated with several greater sage-grouse leks (see Map 2.4-7). The southern boundary of DA-1 is the approximate boundary of the mostly contiguous leases to the north (see Map 1.1-2 in Chapter 1) and the checkerboard patterned leases to the south (DA-2). The east-west boundaries of DA-1 are defined by the Alternative C Core Area (see Map 2.4-5). Year-round drilling and completions with temporary relaxation of seasonal wildlife stipulations (big game crucial winter range and greater sage-grouse breeding and nesting habitats) would be allowed within DA-1 with specific limitations.

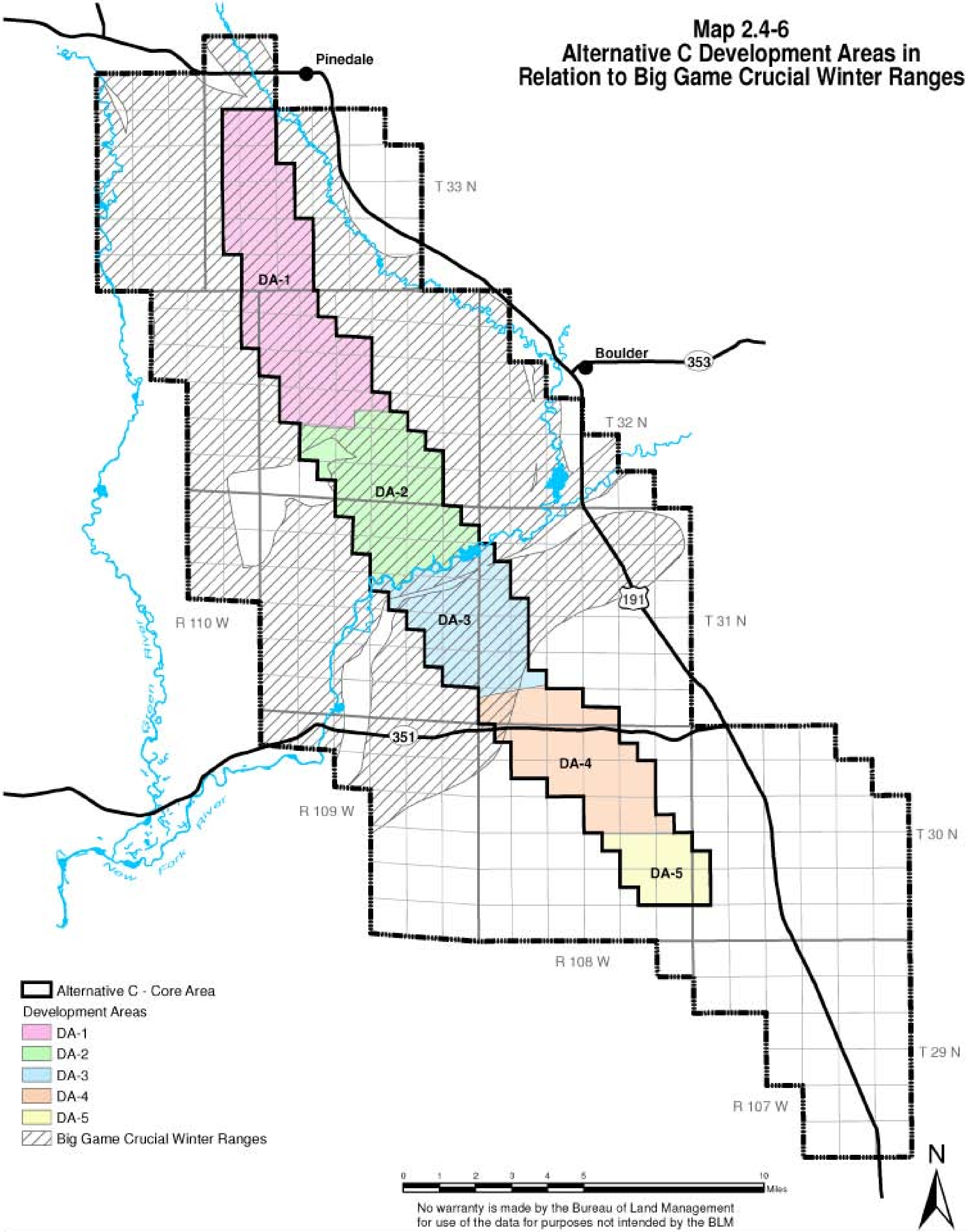
  Initial (2007) year-round drilling would be restricted to a 2-mile wide area (south to north) beginning at the southern boundary of DA-1. As initial development is completed, the 2-mile wide area would move north. Development activities would not be able to advance to the north until the southern initial development is completed and final reclamation measures have been initiated. As development moves to the north, year-round activities would continue to be confined to within a 2-mile wide south to north zone. It is assumed that by the time the 2-mile wide drilling area reaches the northern-most portion of DA-1, the southern-most portion would have achieved a self-replicating vegetative community functioning at a pre-disturbance level. The pattern of development moving north while reclamation is initiated to the south would continue until DA-1 is fully developed. Once final reclamation has been initiated, no new development would occur in the areas to the south of the ongoing development.

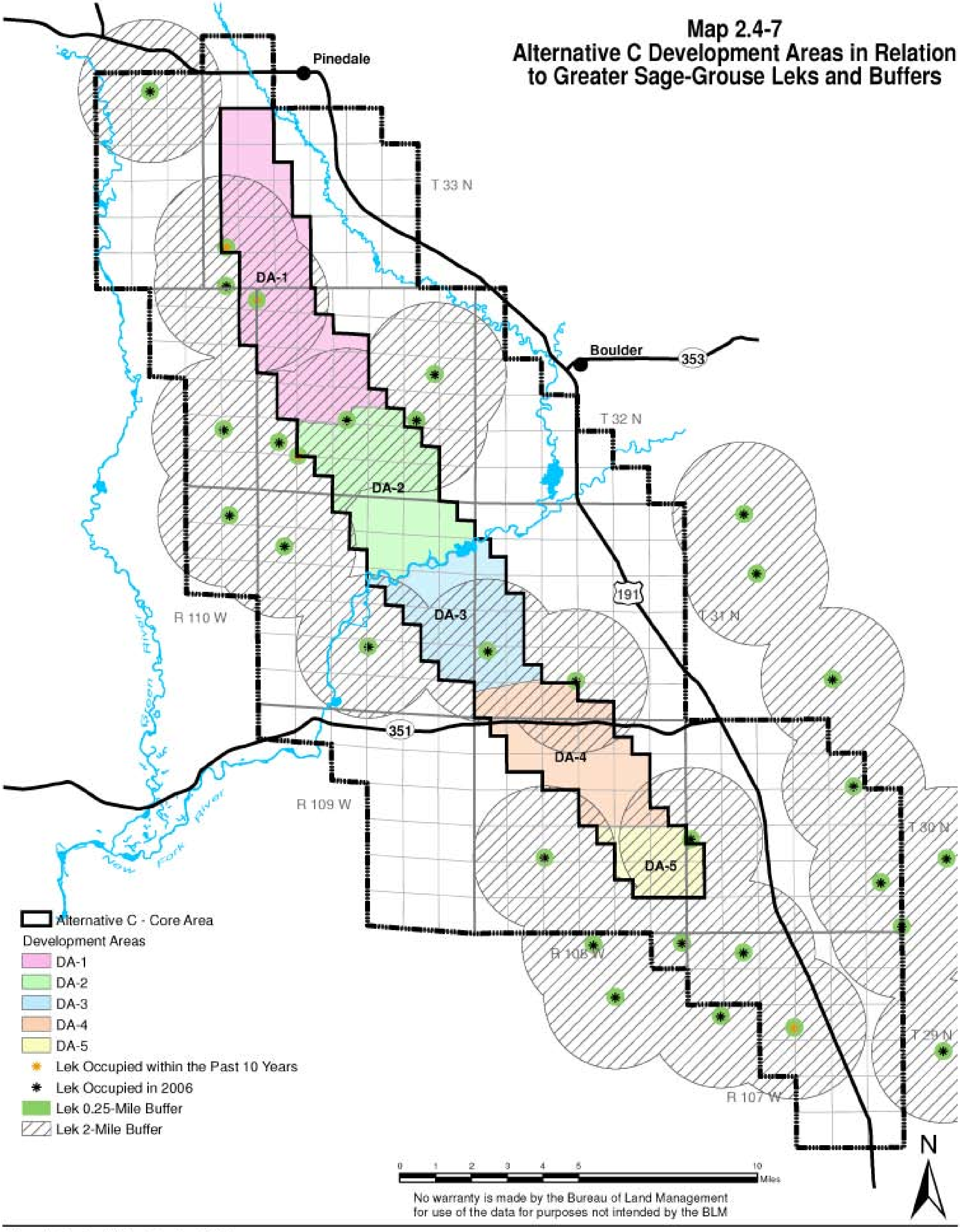
  Development activities could occur in all areas of DA-1 outside of the seasonally restricted periods except for areas that have been fully developed. Such development could include expansion of existing pads, construction of new consolidated pads, single well delineation pads, roads, and gathering pipelines.

- DA-2 – this is located north of the New Fork River in the central portion of the PAPA, is mostly within big game crucial winter ranges (see Map 2.4-6), and overlaps portions of 2-mile buffers associated with several greater sage-grouse leks (see Map 2.4-7). The northern boundary of DA-2 is the southern boundary of DA-1 (see Map 2.4-6). The southern boundary of DA-2 is the New Fork River. The east-west boundaries of DA-2 are defined by the Alternative C Core Area. Year-round drilling and completions with temporary relaxation of seasonal wildlife stipulations (big game crucial winter range and greater sage-grouse breeding and nesting habitats) would be allowed within DA-2 with specific limitations.

  Year-round development activities would be allowed to occur within all areas of DA-2 beginning in 2007 and lasting until DA-2 is entirely developed. Once DA-2 is entirely developed, no new surface disturbance or drilling would be allowed to occur during any season for the remaining life of the project.

Map 2.4-6
Alternative C Development Areas in Relation to Big Game Crucial Winter Ranges




Map 2.4-7
Alternative C Development Areas in Relation to Greater Sage-Grouse Leks and Buffers
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
DA-1
DA-2
DA-3
DA-4
DA-5
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Alternative C - Core Area
Development Areas
DA-1
DA-2
DA-3
DA-4
DA-5
Lek Occupied within the Past 10 Years
Lek Occupied in 2006
Lek 0.25-Mile Buffer
Lek 2-Mile Buffer
0 1 2 3 4 5 10
Miles
N
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- DA-3 – this is located south of the New Fork River in the central portion of the PAPA and is mostly within big game crucial winter ranges (see Map 2.4-6). The northern boundary of DA-3 is the New Fork River and the southern boundary is the southern border of the 0.25-mile buffer on the Lander Trail. East-west boundaries of DA-3 are defined by the Alternative C Core Area.

  Year-round drilling and completions would be allowed to occur within all areas of DA-3. However, year-round drilling would not begin in DA-3 until all development activities (drilling and completions) are completed in DA-2. Development activities could occur in all areas of DA-3 outside of the seasonally restricted periods beginning in 2007.

- DA-4 – this is located in the southern portion of the PAPA. There is a small portion of big game crucial winter ranges that coincide with DA-4 (see Map 2.4-6) and the majority of DA-4 is within 2 miles of several greater sage-grouse leks (see Map 2.4-7). The northern boundary of DA-4 is the southern border of the 0.25-mile buffer on the Lander Trail. The southern boundary of DA-4 was defined by the BLM ID Team to be approximately 1.0 mile from the nearest greater sage-grouse lek that is associated with the Yellowpoint Lek Complex. The boundary is defined by Sections 13, 14, and 15 to the north and Sections 22, 23, and 24 to the south, all of which are in T. 30 N., R. 108 E. East-west boundaries of DA-4 are defined by the Alternative C Core Area.

  Year-round drilling and completions would be allowed within all areas of DA-4 beginning in 2007 and lasting until DA-4 is entirely developed. BLM would temporarily relax stipulations that would otherwise protect greater sage-grouse leks and greater sage-grouse nesting habitat. Once DA-4 is entirely developed, no new surface disturbance or drilling would be allowed to occur.

- DA-5 – this southernmost DA extends south from the border with DA-4. All of DA-5 is within 2 miles of at least one greater sage-grouse lek in the Yellowpoint Lek Complex (see Map 2.4-7). None of DA-5 coincides with big game crucial winter ranges (see Map 2.4-6). The southern boundary of DA-5 is the northern boundary of the Jonah Field Project Area. East-west boundaries of DA-5 are defined by the Alternative C Core Area. Drilling and completions would comply with the stipulations to protect greater sage-grouse leks and nesting habitat.

Proposed project components and estimates of initial and LOP disturbance under Alternative C are provided in Tables 2.4-11 and 2.4-12 for development through 2011 and 2023, respectively. The initial disturbance under Alternative C through 2011 is estimated to be 6,856.6 acres, with a LOP disturbance of 2,069.0 acres. Through 2023, the initial disturbance is estimated to be 12,271.6 acres with a LOP disturbance of 4,095.6 acres.

The estimates used under Alternative C, including the number of wells to be drilled, the number of drilling rigs required, the volume of associated traffic and the size of the required workforce, are the same as those described for the Proposed Action Alternative.

Table 2.4-11
Proposed Project Components and Estimated Initial and Life of Project Disturbance under Alternative C through 2011

Component	Number or Miles	Total (acres)	LOP Disturbance (acres)
Well Pads, Roads and Gas Gathering Pipelines			
Well Pads[1]	179 wells	3,427.0	1,370.8
Local and Resource Roads[2]	89.3 miles	541.5	433.2
Gas Gathering Pipelines[3]	87.1 miles	527.9	0.0
Liquid Gathering Pipelines	236.3 miles	1,432.8	0.0
Subtotal		**5,929.2**	**1,804.0**
Trunk Pipelines and Ancillary Facilities[5]		927.4	265.0
Total – Wellfield Components		**6,856.6**	**2,069.0**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, estimate for miles of proposed roads based on factors determined from existing roads. LOP disturbance assumes 20 percent reclamation of roads.
[3] Estimate for miles of proposed gas gathering pipelines based on factors determined from existing roads.
[4] Estimate for miles of proposed liquid gathering pipelines are based on data provided by QGM, Shell and Ultra.
[5] Detail for trunk pipelines and ancillary facilities is described in Table 2.4-8 for the Proposed Action Alternative 2011.

Table 2.4-12
Proposed Project Components and Estimated Total and Life of Project) Disturbance under Alternative C through 2023

Component	Number or Miles	Total (acres)	LOP Disturbance (acres)
Well Pads, Roads and Gas Gathering Pipelines			
Well Pads[1]	250 pads	8,112.0	3244.8
Local and Resource Roads[2]	120.8 miles	732.2	585.8
Gas Gathering Pipelines[3]	117.5 miles	712.0	0.0
Liquid Gathering Pipelines	295 miles	1,788.0	0.0
Subtotal		**11,344.2**	**3,830.6**
Trunk Pipelines and Ancillary Facilities[5]		927.4	265.0
Total Wellfield Components		**12,271.6**	**4,095.6**

[1] Disturbance includes new well pads and expansion of existing well pads. LOP disturbance assumes 60 percent reclamation of well pads.
[2] Assumes no new collector roads would be built within the PAPA, estimate for miles of proposed roads based on factors determined from existing roads. LOP disturbance assumes 20 percent reclamation of roads.
[3] Estimate for miles of proposed gas gathering pipelines based on factors determined from existing roads.
[4] Estimate for miles of proposed liquid gathering pipelines are based on data provided by QGM, Shell and Ultra.
[5] Detail for trunk pipelines and ancillary facilities is described in Table 2.4-8 for the Proposed Action Alternative 2011.

2.4.2.5 Summary of Surface Disturbance for Alternatives Analyzed in Detail

A comparison of the alternatives is provided in Table 2.4-13 showing estimates of initial and LOP disturbance for each of the alternatives. LOP disturbance is the amount of disturbance remaining once development is complete. A comparison of impacts to each resource for all alternatives analyzed in detail is provided in Appendix F.

Table 2.4-13
Summary of Surface Disturbance for Alternatives Analyzed in Detail

Project Component	Total Number, Area (acres), or Length (miles) of Component				
	Alternative A No Action (2011)	Alternative B Proposed Action (2011)	Alternative C (2011)	Alternative B Proposed Action (2023)	Alternative C (2023)
New Well Pads	245	179	179	250	250
Initial Surface Disturbance (all wellfield components - acres)	4,484.5	6,845.0	6,856.6	12,278.4	12,271.6
LOP Acres Surface Disturbance (all wellfield components – acres)	1,314.5	2,065.8	2,069.0	4,093.3	4,095.6
Initial Surface Disturbance (Well pads, roads and gathering pipelines – acres)	3,890.3	5,917.6	5,929.2	11,351.0	11,344.2
LOP Surface Disturbance (Well pads, roads and gas gathering pipelines – acres)	1,179.5	1,800.8	1,804.0	3,828.3	3,830.6
Initial Surface Disturbance Other Components (acres)	594.2	927.4	927.4	927.4	927.4
LOP Surface Disturbance Other Components – acres	135.0	265.0	265.0	265.0	265.0
Miles of Local and Resource Roads	108.0	88.7	89.3	120.8	120.8
Miles of Gas Gathering Pipelines	105.6	93.1	87.1	118.6	117.5
Miles of Liquid Gathering Pipeline	6.0	235.8	236.3	295.0	295.0
Number of Wells Drilled	1,139	1,453	1,453	4,399	4,399
LOP=life of project					

2.4.3 Alternatives Considered but not Analyzed in Detail

2.4.3.1 Conservation Alternative

The Conservation Alternative would be similar to the No Action Alternative but would require additional mitigation. All seasonal wildlife restrictions would apply and there would be no exceptions allowed. All Operators would be required to use liquid gathering systems for transport of condensate and produced water to central gathering facilities. No new pads would be allowed in a quarter-section (approximately 160 acres) if there are one or more existing pads. Operators would be required to expand existing pads unless there are topographical constraints. Operators would be required to drill out a quarter-section before moving to another area and would not be allowed to return. No more than four well pads per section would be allowed. Operators would be required to have Tier 2 equivalent emission controls on all drilling rigs within the PAPA, and all completions would be required to be “green” (recover most of the production rather than flaring it all). This alternative was not analyzed in detail for the following reasons:

- The use of Tier 2 equivalent emissions on drilling rigs requires that existing rigs either be retrofitted or that new drilling rig engines be built with these emission controls. If all seasonal wildlife restrictions are in effect, Operators are not able to keep drilling rigs through the winter and there is no guarantee that they could get the same drilling rigs (with the controls) back to the PAPA for the spring/summer/fall drilling. This is especially true currently, because drilling rigs are difficult to obtain. Therefore, a more stable drilling rig fleet is necessary for Operators to have emission controls on all drilling rigs. A stable drilling fleet would allow the Operators to use natural gas-fired drilling rigs. This alternative would not allow any relaxation of winter stipulations to enable drilling rigs to stay in the PAPA year-round.

- Although in most cases, Operators would be able to develop the resource on four well pads per section (one well pad per quarter section); in some locations it would not be possible due to topographical constraints or resource constraints. In these locations, more well pads could be required to avoid steep slopes, sensitive soils, greater sage-grouse leks, bald eagle nests, etc.
- Most completion operations in the PAPA are green as specified in the Operators' WDEQ permits. It is unreasonable to expect that all completions be "green" because of safety issues or location (insufficient production pressure).
- The Operators have proposed a long-term development plan for the PAPA which includes a liquids gathering system. Due to the location of leaseholds, the number of wells to be drilled per location, and the request for access in wildlife timing stipulation areas, it is unreasonable to require that all operators be connected to the liquids gathering system for all locations.

2.4.3.2 Maximum Development Alternative

A Maximum Development Alternative was considered but not analyzed in detail. This alternative would include development of natural gas resources by wells with 5-acre bottom hole spacing from the Lance Formation and development of the deeper Rock Spring Formation natural gas resource as yet undefined, on 160-acre bottom hole spacing. This development level would be allowed year-round within a core area flanking the Anticline Crest (where there is maximum potential for development) and would extend to an additional 0.5 mile distance from the core area. If the development would expand beyond the core area and reach a density of two well pads per section, then that would become part of the core area. None of the seasonal wildlife stipulations would apply to the core area. Exceptions would be allowed outside of the core area. There would be no requirement for Tier 2 equivalent emissions control on drilling rig engines. This alternative was considered but not analyzed in detail for the following reasons:

- this alternative would have no provisions for Tier 2 equivalent emissions on drilling rigs. Previous air quality impact analysis (BLM, 2006a) has shown that at least some control of drilling rig emissions is required for this level of development due to the proximity of the PAPA to the Bridger Wilderness Area; and
- under this alternative, there would be no provision for consolidating development to allow for areas with no drilling activity during seasonal timing restrictions along the Anticline Crest.

2.4.3.3 Reduced Pace of Development Alternative

A Reduced Pace of Development Alternative would include all of the elements of the Proposed Action but would require that the resource be developed over a longer period. This alternative was considered but not analyzed in detail for the following reasons:

- the No Action Alternative has the elements of a reduced pace of development, due to the seasonal wildlife stipulations. Although subsequent Decision Records (BLM, 2004a, 2005a, 2005b, and 2005c) have allowed for increased winter drilling, comparison of the No Action Alternative to the Proposed Action Alternative shows that there is still an element of reduced pace of development in the No Action Alternative. For the most part, seasonal wildlife stipulations would still be in effect;

- a reduced pace of development would increase the overall period for development of natural gas resources in the PAPA; and
- a reduced pace of development would not be in keeping with the Energy Policy Act of 2005 which emphasizes the development of domestic natural gas reserves for supply and economic stability.

2.4.3.4 Alternative Pipeline Corridor and Sales Pipeline Alignment

An alternative route for BCC, R6 Pipeline (Segment 1) and the PBC Pipeline was initially considered. The alternative route deviated from the proposed route at approximate milepost 12.1 and returned to the proposed route at milepost 17.1 (see Map 2.4-2). The 6.4-mile long segment would replace 5.0 miles of the proposed route. The alternative route was considered but not analyzed in detail for the following reasons:

- a 500-foot corridor would be required for two large diameter pipelines with 120-foot construction rights-of-way, which is unavailable along the alternative route;
- there is one greater sage-grouse lek within 0.25 mile, and one lek within 2 miles, of the alternative alignment and there would have been seasonal restrictions on pipeline construction;
- the length of the alternative pipeline segment between the two points of deviation was longer than the proposed route's segment; therefore there would be less surface disturbance to vegetation, soils, and wildlife habitat, and overall, less environmental impact, in general, by using the proposed route; and
- there are fewer sensitive cultural resources along the proposed route in comparison to the alternative route.

Chapter 3
Affected Environment

3.1 INTRODUCTION

This chapter describes the condition of the existing human and natural environment in the PAPA and the degree specific resources have been affected by natural gas development. Relevant management objectives that BLM advanced for each resource in the Pinedale RMP (BLM, 1988b) were reviewed for maintenance changes made since the RMP was first published. Maintenance changes are included in the annotated version of the RMP available online (BLM, 2006b). None of the management objectives included in the PAPA DEIS (BLM, 1999a) has changed. Relevant management objectives advanced by BLM in the Green River RMP (BLM, 1997), the Kemmerer RMP (BLM, 1986), and in subsequent revisions were reviewed by resource. None of the management objectives included in these two RMPs has changed; however, the Kemmerer RMP is under revision. Management objectives for each of the three RMPs are not repeated here.

BLM Manual H-1790-1 (BLM, 1988a) lists critical elements that must be addressed in every EIS. These are:

- air quality;
- Areas of Critical Environmental Concern;
- cultural resources;
- environmental justice;
- farmlands;
- flood plains;
- invasive non-native species;
- migratory birds;
- Native American religious concerns;
- threatened or endangered species;
- wastes (hazardous or solid);
- water quality;
- wetlands/riparian zones;
- Wild and Scenic Rivers, and
- designated wilderness.

All of the aforementioned critical elements are potentially affected by implementation of each alternative, with the exception of “Areas of Critical Environmental Concern” and “Wild and Scenic Rivers”. Each critical element is addressed in a level of detail commensurate with the degree of impact to that critical element or resource. For resources where minor impacts are expected to occur, only a brief description is provided. For resources that are expected to be impacted significantly by the alternatives, more detailed information is provided following guidance in BLM Manual H-1790-1 (BLM, 1988a).

For resources described in this chapter, repetition of pertinent information disclosed in the PAPA DEIS (BLM, 1999a) has been avoided. The emphasis in the following discussion is on information and understanding of how each resource has been affected or altered since implementation of the PAPA ROD (BLM, 2000b).

The concept of SRMZs was developed in the PAPA DEIS (BLM, 1999a). A SRMZ is an area that contains resources that require specific surface disturbance limitations, seasonal construction constraints, monitoring, or other actions to ensure that undue impacts to the resource do not occur. SRMZs occupy distinct geographic areas and in many cases, SRMZs for a number of resources overlap. For instance, it is common on the Mesa to have areas located within mule deer, greater sage-grouse, sensitive viewshed, and sensitive soil SRMZs. To address the overlapping SRMZs, the BLM divided the entire PAPA into nine distinct MAs. MA 1 through MA 8 apply only to federal lands and minerals. All nonfederal lands and minerals were combined into MA 9. The MAs and limits to surface disturbance that were approved in the PAPA ROD (BLM, 2000b) are discussed in Chapter 2.

Summaries of quantitative effects to SRMZs and other geographically-oriented resources by current levels of development are provided in the appropriate sections of this chapter. These are the basis for predicting future impacts associated with each alternative analyzed in Chapter 4.

Surface disturbance (the area in acres) by wellfield development was mapped using QuickBird satellite imagery over the entire PAPA. Surface disturbance for 2006 is identified separately in this chapter because the 2006 disturbance is projected by the Operators rather than digitized as actual disturbance on the ground.

Before issuance of the PAPA ROD (BLM, 2000b), approximately 7,467 acres had been disturbed in the PAPA, primarily concentrated on private lands and mostly associated with residential areas, recreational facilities, agricultural operations, and the Wenz Field airport. This disturbance is not associated with natural gas development in the PAPA and is not discussed further in this chapter. As of December 2005, there was a total of 4,679 acres of natural gas related disturbance in the PAPA. Of this, 561 acres were disturbed before issuance of the PAPA ROD and 4,118 acres were disturbed subsequent issuance of the PAPA ROD. These estimates are initial disturbance and do not account for reclamation. The Operators are projecting an additional 381 acres of wellfield disturbance in 2006, for an estimated total of 5,059 acres, which is 2.6 percent of all lands in the PAPA.

As a result of the proposed increase in natural gas production, the BLM, in consultation with the Operators, has identified three potential corridors for pipelines that would carry hydrocarbon products from the PAPA to processing plants in southwestern Wyoming. The pipeline companies have defined two natural gas sales pipelines that would be constructed within the three corridors. Both pipelines would be in one corridor as they leave the PAPA, and then they diverge south of the Bird Canyon Compressor Station. The affected environment for the proposed corridor/pipeline alignments is also discussed below.

3.2 LAND AND MINERAL OWNERSHIP

Federally managed lands and minerals in the PAPA compose approximately 79.3 percent of lands while privately owned lands and minerals account for an additional 11.1 percent. Approximately 4.9 percent of all lands in the PAPA are composed of state owned lands and minerals while the remaining 4.7 percent of the lands in the PAPA are comprised of mixed surface and mineral ownership (see Map 3.2-1 and Table 3.2-1).

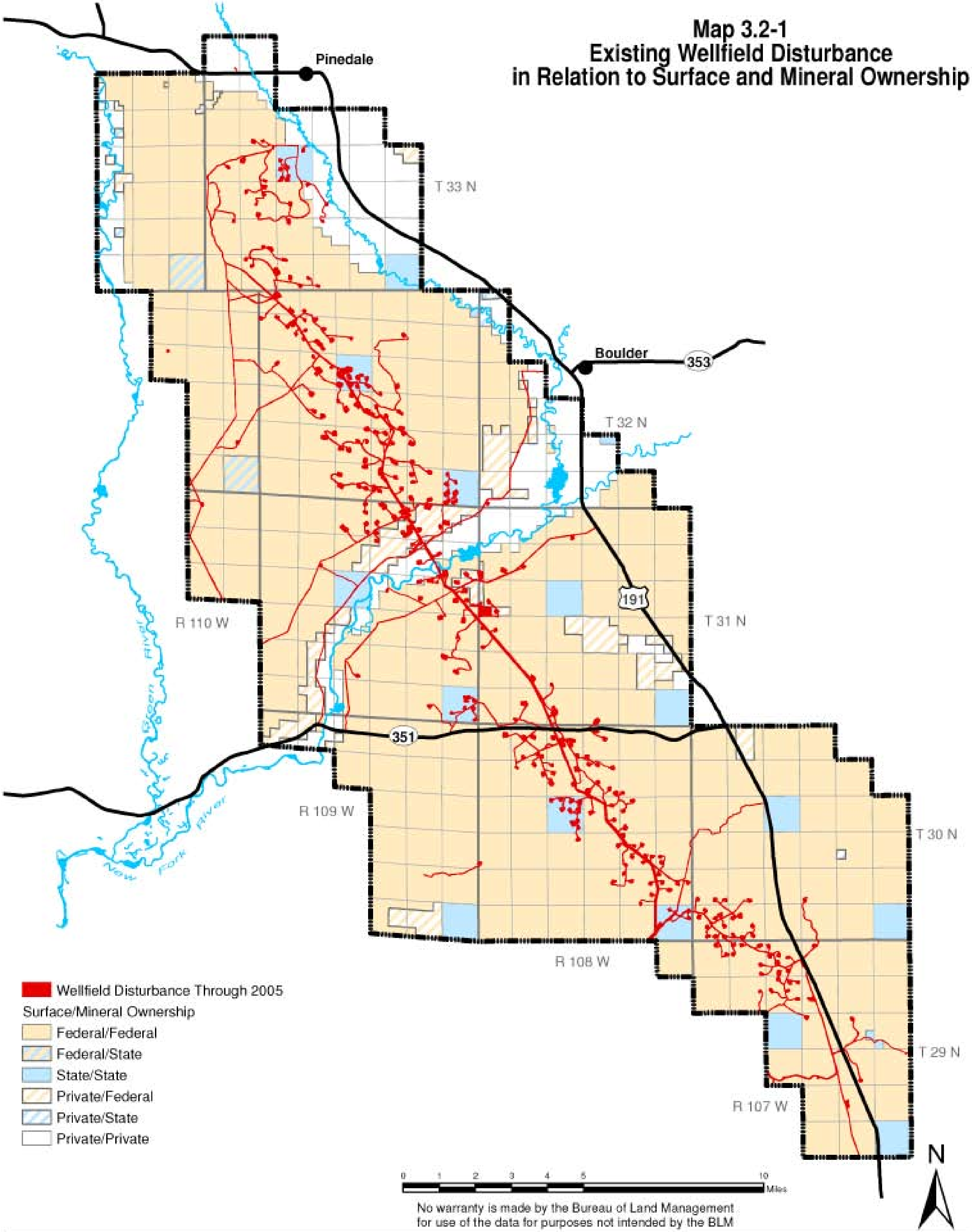

Map 3.2-1
Existing Wellfield Disturbance
in Relation to Surface and Mineral Ownership
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Surface/Mineral Ownership
Federal/Federal
Federal/State
State/State
Private/Federal
Private/State
Private/Private
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Table 3.2-1
Estimated Existing Wellfield Disturbance in Relation to Land and Mineral Ownership

Management/Ownership Category	Surface Area in the PAPA (acres)	Percent	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbed
Federal Surface/Federal Minerals	156,992	79.3	3,672.3	308.6	3,980.9	2.5
Federal Surface/State Minerals	1,279	0.6	0.00	0.0	0.0	0.0
State Surface/State Minerals	9,801	4.9	490.3	17.4	507.7	5.2
Private Surface/Private Minerals	21,896	11.1	218.4	16.9	235.3	1.1
Private Surface/State Minerals	339	0.2	0.0	0.0	0.0	0.0
Private Surface/Federal Minerals	7,727	3.9	297.5	38.0	335.5	4.3
Total	**198,034**	**100.0**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

As stated in the previous section, there were 4,679 acres of wellfield disturbance in the PAPA (2.4 percent) through December 2005 (Table 3.2-1). In 2006, the operators are proposing to disturb an additional 381 acres. At the end of 2006, an estimated 5,060 acres (2.6 percent) of the PAPA will have been disturbed by natural gas related development. Most surface disturbance, since issuance of the PAPA ROD, has been on Federal Surface/Federal Minerals lands.

3.3 CLIMATE

The climate in the region of the PAPA is semiarid and continental, with short, dry summers and long, cold winters. July and August are the hottest months of the year, while December and January are the coldest. Freezing temperatures can occur anytime of the year (Martner, 1986). According to the National Weather Service (NWS), Pinedale's mean temperature in January is 12.6°F with a mean of 59.8°F in July (Western Regional Climate Center, 2006). High elevation and dry air facilitate thermal radiation gain and loss, as evidenced by Pinedale's wide variation between daily minimum and maximum temperatures (BLM, 1999a).

Annual precipitation (including rain and the water equivalent in snow) in the PAPA averaged 10.6 inches over the 30 water years (a water year extends from October through September) from 1970-1971 through 1999-2000. Snowfall from October through April averages 58 inches in the PAPA (Table 3.3-1).

Table 3.3-1
Estimated Values of Climate Parameters since 2000 Compared to the 30-Year Average from Water Year 1970-1971 through Water Year 1999-2000[1]

Climate Parameter	30-year Average (1971-2000)	Parameter Values in Water Year				
		2001	2002	2003	2004	2005
Total Precipitation (inches in Water Year)	10.58	5.45	6.26	8.00	11.29	11.78
Total Snowfall (inches October-April)	57.87	43.54	34.91	49.01	58.89	53.02
Average Monthly Temperature (^{o}F)	35.84	36.06	35.04	36.82	34.61	36.40
Average Minimum Monthly Temperature (^{o}F)	19.67	18.62	17.79	20.26	18.63	20.40
Average Maximum Monthly Temperature (^{o}F)	52.02	53.36	52.28	53.37	50.59	52.40

[1] Source: Western Regional Climate Center, 2006.

Beginning in 2000 and continuing through 2003, precipitation in the PAPA was consistently below the 30-year average, exhibiting drought conditions. Precipitation during water years 2004 and 2005 was above the 30-year average. Total snowfall (October through April) estimated in the PAPA has been below the 30-year average of 58 inches since 1987 except during winter 2003-2004. Maximum monthly temperatures, averaged by water year, have generally been above the 30-year average (Table 3.3-1).

The region is subject to strong and gusty winds, reflecting channeling and mountain valley flows due to complex terrain. During the winter, strong winds are often accompanied by snow, producing blizzard conditions. The closest comprehensive wind measurements were collected in the Jonah Field Project Area adjacent to the southeast corner of the PAPA at a meteorological station operated by BP America from 1999 through 2003. Winds in the PAPA (Table 3.3-2) are from the west to northwest approximately 40 percent of the time.

Table 3.3-2
Wind Direction Frequency Distribution in the Vicinity of the PAPA Averaged from 1999 through 2003 [1]

Wind Direction	Frequency (%)
N	5.3
NNE	3.9
NE	3.5
ENE	3.9
E	3.8
ESE	3.3
SE	2.9
SSE	2.8
S	3.8
SSW	4.8
SW	6.0
WSW	6.6
W	9.9
WNW	15.9
NW	14.4
NNW	9.2

[1] Source: BP America, 2004.

While the annual mean wind speed is 11.2 miles per hour (mph), wind speeds in excess of 19 mph occur more than 12 percent of the time (Table 3.3-3).

Table 3.3-3
Distribution of Wind Speeds in the Vicinity of the PAPA Averaged from 1999 through 2003 [1]

Wind Speed (mph)	Frequency (%)
0 – 4.0	9.1
4.0 – 7.5	25.4
7.5 – 12.1	28.1
12.1 – 19.0	24.7
19.0 – 24.7	7.2
Greater than 24.7	5.5

[1] Source: BP America, 2004.

The atmospheric stability class (Table 3.3-4) is a measure of atmospheric turbulence, which directly affects pollutant dispersion. The stability classes are divided into six categories designated “A” (unstable) through “F” (very stable). The “D” (neutral) stability class occurs more than half of the time. The frequency and strength of winds greatly affect the transport and dispersion of air pollutants. Because of the strong winds in the region, the potential for atmospheric dispersion is relatively high, although nighttime cooling enhances stable air, inhibiting air pollutant mixing and transport.

Table 3.3-4
Atmospheric Stability Class
Distribution Averaged from 1999 through 2003 [1]

Stability Class [2]	Frequency (%)
A	2.4
B	6.1
C	12.2
D	60.2
E	15.4
F	3.7

[1] Source: BP America, 2004.
[2] A = unstable; D = neutral; F = very stable

3.4 ENVIRONMENTAL JUSTICE

Federal agencies are required to conduct programs, policies, and activities that substantially affect human health or the environment in a manner that ensures no person is excluded from participation therein, denied the benefit thereof, or subjected to discrimination due to race, color, or national origin. Executive Order 12898 requires federal agencies to assess their projects to ensure they do not result in disproportionately high or adverse environmental, health, or safety effects to minority or low-income populations.

The minority populations in Lincoln, Sublette, and Sweetwater counties constitute smaller percentages of total population than figures for the United States as a whole (Table 3.4-1). There is a lower percentage of the population below the poverty line in Lincoln, Sublette, and Sweetwater counties than for the State of Wyoming and U.S. as a whole.

Table 3.4-1
Race and Poverty as a Percentage of Total Population in 2000[1]

State or County	White	Black or African-American	American Indian and Alaska Native	Asian	Native Hawaiian and other Pacific Islander	Some other race	Persons reporting other race or multiple races	Total[2]	Hispanic or Latino origin[3]	Below the poverty -line
Lincoln	97.1	0.1	0.6	0.2	0.1	0.7	1.2	100.0	2.2	9.0
Sublette	97.5	0.2	0.5	0.2	0.1	0.5	1.0	100.0	1.9	9.7
Sweetwater	91.6	0.7	1.0	0.6	0.0	3.6	2.4	99.9	9.4	7.8
Wyoming	92.1	0.8	2.3	0.6	0.1	2.5	1.8	100.2	6.4	11.4
U.S.	75.1	12.3	0.9	3.6	0.1	5.5	2.4	99.9	12.5	12.4

[1] U.S. Census Bureau, 2006.
[2] This table uses US Census Bureau statistics which, due to rounding, may total slightly more or less than 100%.
[3] People who identify their origin as Hispanic or Latino may be of any race. Thus the percent Hispanic or Latino should not be added to the race as a percentage of population categories.

3.5 SOCIOECONOMIC RESOURCES

The affected environment for socioeconomic resources includes Sublette, Sweetwater and Lincoln counties. The discussion is for the proposed development within the PAPA and for the proposed corridor/pipeline alignments.

3.5.1 Socioeconomic Trends

Sublette, Sweetwater, and Lincoln counties are primarily rural, and their sparse population historically relied on livestock ranching (Rosenberg, 1990; Blevins et al., 2004; and BLM, 2006a). While ranching remains culturally important in southwestern Wyoming, the region's economy has shifted toward mineral extraction (including natural gas production). Sublette County shifted to natural gas drilling about 1920 (Rosenberg, 1990), Lincoln County shifted to coal mining around 1900, and Sweetwater County shifted to trona mining in 1946. Tourism and travel grew as important economic components following World War II (Western, 2002). In 2004, 784 workers were employed in mineral development, 580 in travel/tourism, and 390 in agriculture in Sublette County. That same year in Lincoln County, 688 workers were employed in agriculture, 684 in mineral development, and 590 in travel. In Sweetwater County, an estimated 4,391 workers were employed in mineral development, 1,820 in travel/tourism, and 195 in agriculture in 2004 (U.S. Department of Commerce, 2006 and Dean Runyan Associates, 2005).

The significance of oil and gas revenues to the region's economy has increased and is expected to grow (BLM, 2006a). In 1985, oil and gas interests contributed over 80 percent of tax revenues in Sublette County (Rosenberg, 1990). In 2005, oil and gas production and ancillary facilities accounted for 96 percent of the total assessed valuation for Sublette County, 55 percent for Lincoln County, and 61 percent for Sweetwater County (Wyoming Department of Revenue, 2006). Since 2000, the assessed valuation growth index for Sublette County has increased substantially and has outpaced the statewide average, but Sweetwater County and Lincoln County have trailed the statewide average (Table 3.5-1). Per-capita assessed valuation revenues from oil and gas production facilities are substantially higher for Sublette County than for neighboring counties or for the Wyoming state average (Table 3.5-2).

Table 3.5-1
Total Assessed Valuation and Assessed Valuation Indices, Southwestern Wyoming from 2000 to 2005

Year	Lincoln County (millions)	Sublette County (millions)	Sweetwater County (millions)	Wyoming (billions)	Lincoln County Index	Sublette County Index	Sweetwater County Index	Wyoming Index
2000	$437.8	$475.8	$1,126.3	$7.9	100.0	100.0	100.0	100.0
2001	$574.1	$851.3	$1,407.0	$10.5	131.1	178.9	124.9	133.5
2002	$591.7	$1,097.1	$1,404.3	$11.2	135.1	230.6	124.7	141.4
2003	$448.0	$934.7	$1,160.7	$10.3	102.3	196.4	103.1	130.9
2004	$597.5	$2,039.1	$1,563.3	$13.7	136.5	428.5	138.8	173.2
2005	$753.1	$2,924.0	$1,821.9	$16.4	172.0	614.5	161.8	208.2
Source: Wyoming Department of Revenue, 2006.								

Table 3.5-2
Per-Capita Assessed Valuation from Oil and Gas Production Facilities, Southwestern Wyoming from 2000 to 2005

Year	Lincoln County Per-Capita	Sublette County Per-Capita	Sweetwater County Per-Capita	State of Wyoming Per-Capita
2000	$30,042	$80,378	$29,944	$15,993
2001	$38,957	$143,389	$38,268	$21,338
2002	$39,604	$176,362	$37,654	$22,381
2003	$29,380	$147,008	$31,289	$20,601
2004	$38,130	$306,452	$41,612	$27,041
2005	$47,074	$422,177	$47,976	$32,290
Source: Wyoming Department of Revenue, 2006.				

In 2004, per-capita sales tax collections were $745 in Lincoln County, $3,856 in Sublette County, and $1,362 in Sweetwater County. The average Wyoming per-capita sales tax collections are $723 (Coupal et al., 2006).

Oil and gas exploration and drilling operations in southwestern Wyoming have been cyclical in nature. During the 1970s, as activity increased in southern Sublette County, employment in the oil and gas sector steadily grew. Employment spiked in the early 1980s when natural gas processing plants were built in southwestern Wyoming but employment dropped in the mid-1980s. There was gradual job growth in the oil and gas sector in southwestern Wyoming during the 1990s with increased exploration and development of the Jonah Field Project Area and the PAPA.

Since 1999, job growth associated with oil and gas development has increased at an accelerating rate (Table 3.5-3). Average annual earnings per development job ($49,372) and average earnings per production job ($52,241) are higher than wages paid in other employment sectors (Jacquet, 2006). Employment related to natural gas development in the PAPA constitutes an increasing component of total regional employment from 2000-2005 (Table 3.5-4). In a 1997 survey, the University of Wyoming reported that residents believed oil and gas would be more important than hospitality or agriculture industries in Sublette County within the next 10 years (McLeod et al., 1997). Sublette County residents have recently expressed strong opinions on both sides of the issues associated with changes and growth accompanying oil and gas exploration and drilling.

Increased tax revenues from oil and gas development in the PAPA have supported infrastructure investments in Sublette County. Recent community projects in Sublette County include expansion of the county library, extension and renovation of the courthouse, remodeling in School District Number 1, a new riding arena, baseball fields, a skateboard park (Blevins et al., 2004), a new jail, landfill, senior center, and a public clinic upgrade (BLM, 2006b). The county is making plans to build a $17.2 million aquatic center, which includes a three-story climbing wall, two racquetball courts, and a competition-sized swimming pool (Gruver, 2006). Some residents fear that a future lag in oil and gas exploration makes it imprudent to continue to increase infrastructure investments in the county. For example, in the early 1980s, the second phase of a drilling project failed to occur and the county had already constructed a high school with 50 percent surplus capacity. Accordingly, local residents are engaged in an ongoing debate concerning the appropriate scope and pace for oil and gas development in Sublette County, and the appropriate level of infrastructure investments to support growth and development.

Table 3.5-3
Employment and Earnings Associated with Natural Gas Development from 2000 to 2005

PAPA Related Data	2000	2001	2002	2003	2004	2005
Resource Development Phase:						
Wells Drilled [1]	2	40	59	77	122	120
Wells Completed [2]	2	39	58	75	119	117
Per-well employment: drilling	34.5	34.5	34.5	34.5	34.5	34.5
Per-well employment: completion	16.3	16.3	16.3	16.3	16.3	16.3
Total Development Employment	**103**	**2,015**	**2,997**	**3,875**	**6,148**	**6,045**
Per-well earnings: drilling	$1,726,956	$1,726,956	$1,726,956	$1,726,956	$1,726,956	$1,726,956
Per-well earnings: completion	$779,512	$779,512	$779,512	$779,512	$779,512	$779,512
Total Development Earnings	**$5,101,498**	**$99,479,208**	**$147,943,438**	**$191,306,170**	**$303,539,123**	**$298,437,625**
Average earnings per development job	$49,372	$49,372	$49,372	$49,372	$49,372	$49,372
Resource Production Phase:						
Natural Gas Production (MMSCF)	8,195	14,946	41,910	80,504	136,330	179,160
Per MMSCF employment	0.002008	0.002008	0.002008	0.002008	0.002008	0.002008
Total Production Employment	**16**	**30**	**84**	**162**	**274**	**360**
Per MMSCF Earnings	104.90	$104.90	$104.90	$104.90	$104.90	$104.90
Total Production Earnings	$859,668	$1,567,866	$4,396,327	$8,444,871	$14,300,972	$18,793,907
Average earnings per production job	$52,241	$52,241	$$52,241	$52,241	$52,241	$52,241

[1] Assumes 2.5 percent of wells are dry holes.
[2] WOGCC, 2006.

Table 3.5-4
Per-Capita Share of Total Regional Employment Including the Contribution by the PAPA

Region	2000	2001	2002	2003	2004	2005 (estimated)
Lincoln County	8,114	8,434	8,517	9,311	9,292	9,069
Sublette County	3,977	4,251	4,482	4,704	5,204	6,682
Sweetwater County	24,249	24,493	24,118	25,017	26,033	27,907
Total Tri-County Employment	36,340	37,178	37,117	39,032	40,529	43,658
Percent employed in the PAPA	0.3%	5.5%	8.3%	10.3%	15.8%	14.7%

Source: U.S. Department of Commerce, 2006.

The production from the PAPA represents 5.96 percent of Wyoming's natural gas production. The PAPA is the third largest oil and gas production field in Wyoming (WOGCC, 2006). The three-county region produces 19.31 percent of the oil produced in Wyoming and 53.97 percent of the natural gas produced in Wyoming (Table 3.5-5).

Table 3.5-5
Oil and Gas Production in Lincoln, Sublette, and Sweetwater Counties, 2004

County	Producing Wells	Oil (BBLS)	Percent of Wyoming's Oil Total	Natural Gas (MCF)	Percent of Wyoming's Gas Total
Lincoln	1,123	749,760	1.45	81,275,331	4.22
Sublette	2,339	4,698,953	9.10	726,051,744	37.66
Sweetwater	2,501	4,523,944	8.76	232,993,490	12.09
Total	**5,963**	**9,972,657**	**19.31**	**1,040,320,565**	**53.97**
Source: WOGCC, 2006.					

3.5.2 Population

The population of southwestern Wyoming is growing (Table 3.5-6). From 2000 to 2005, Sublette County grew an estimated 17 percent (1,006 people); Lincoln County grew an estimated 10 percent (1,426 people); and Sweetwater County grew less than 1 percent (362 people), compared with 3.1 percent growth for Wyoming and 5 percent growth for the United States. Census statistics underestimate the pace of growth in southwestern Wyoming because the statistics fail to recognize the increasing presence of transient workers who consider residences outside the counties their primary homes (Blevins et al., 2004). Furthermore, these data neither reflect growth which occurred in 2006, nor forecast the impacts of increased drilling activity.

Table 3.5-6
Population Estimates in Southwestern Wyoming from 2000 to 2005

Location	2000	2004	2005	Percent Change 2000-2004	Percent Change 2000-2005
Lincoln County	14,573		15,999	0	10
Afton	1,797	1,818	NA	1	0
Kemmerer	2,651	2,561	NA	-3	0
LaBarge	431	NA	NA	0	0
Opal	102	NA	NA	0	0
Sublette County	5,920		6,926	0	17
Big Piney	408	444	455	9	0
Boudurant	155	NA	NA	0	0
Boulder	30	NA	NA	0	0
Cora	76	NA	NA	0	0
Daniel	89	NA	NA	0	0
Marbleton	720	789	811	10	0
Pinedale	1,412	1,575	1,658	12	0
Sweetwater County	37,613		37,975	0	<1
Eden	388	NA	NA	0	0
Farson	242	NA	NA	0	0
Green River	11,808	11,807	NA	0	0
Rock Springs	18,708	18,746	NA	<1	0
Wyoming	493,782		509,294		
Source: U.S. Census Bureau, 2006. NA = not available					

In 2000, second homes in Sublette County were 26.2 percent of the total housing units, with 13.4 percent and 1.5 percent in Lincoln County and Sweetwater County, respectively. Southwestern Wyoming has a higher rate of second home ownership than the state as a whole (5.5 percent) (Taylor and Lieske, 2002).

Between 2000 and 2005, 71 percent of Lincoln County's growth and 90 percent of Sublette County's growth was from immigration rather than natural increase, contrasted with 26 percent immigration for Wyoming as a whole. Sweetwater County experienced an estimated net emigration of 1,118 people, and its population growth was entirely attributed to natural increase (births exceeding deaths).

Populations are expected to continue to grow in southwestern Wyoming in the second half of this decade. In late 2005, 524 natural gas industry workers in the PAPA and Jonah Field Project Area were casually surveyed. Almost half of the respondents (212) considered themselves nonresidents, and 64 percent of these nonresidents (136 individuals or families) said they were considering permanent relocation to the area. Respondents were more interested in moving to Sublette County (especially Pinedale and Boulder) than Sweetwater County (Sublette SE, 2006). Forecasts of population for southwestern Wyoming are presented in Table 3.5-7.

Table 3.5-7
Population Forecasts for Selected Locations in Southwestern Wyoming from 2006 to 2020

Location	2006 Forecast	2010 Forecast	2015 Forecast	2020 Forecast
Lincoln County	16,195	16,991	18,111	19,293
Afton	1,913	2,007	2,139	2,279
Alpine	742	779	830	884
Cokeville	528	554	591	629
Diamondville	748	785	837	891
Kemmerer	2,746	2,881	3,071	3,271
La Barge	449	471	502	535
Opal	106	111	119	127
Thayne	363	381	406	433
Sublette County	7,112	7,741	8,638	9,634
Big Piney	483	525	586	654
Marbleton	854	930	1,037	1,157
Pinedale	1,681	1,829	2,041	2,277
Sweetwater County	38,300	38,558	39,029	39,485
Bairoil	98	99	100	101
Granger	148	149	151	153
Green River	11,977	12,057	12,205	12,347
Rock Springs	19,004	19,132	19,366	19,592
Superior	246	247	250	253
Wamsutter	269	270	274	277
TOTAL	**61,606**	**63,290**	**65,778**	**68,413**
Source: Wyoming Department of Administration and Information, 2006a.				

3.5.3 Employment and Income Level

Southwestern Wyoming's recent unemployment data are mixed. Sublette County has experienced lower unemployment rates than the State of Wyoming, while state unemployment levels were among the lowest in the country from 2000 to 2005 (Table 3.5-8). Lincoln and Sweetwater counties experienced unemployment rates above both state and national levels until 2004 and 2005, when unemployment rates in both counties dropped due to tightening labor markets.

Table 3.5-8
Comparative Unemployment Levels (percent)
in Southwestern Wyoming and the United States from 1999 to 2005

Year	Lincoln County	Sublette County	Sweetwater County	Wyoming	United States
1999	6.2	3.7	6.2	4.9	4.2
2000	5.1	2.5	4.9	4.0	4.0
2001	5.0	1.9	4.4	3.6	4.7
2002	5.9	2.5	4.5	4.0	5.8
2003	5.8	2.7	4.0	4.1	6.0
2004	3.9	2.3	3.4	3.9	5.5
2005	3.9	1.8	3.0	3.6	5.1
July, 2006	2.3	1.8	3.0	3.6	5.1
Source: Wyoming Department of Employment, 2006.					

Per-capita income in Sublette County in 2000 was higher than in Lincoln and Sweetwater counties and higher than the Wyoming average (Table 3.5-9). In 2000, the median household income of each of the three counties exceeded the state average, and Sweetwater County's median household income exceeded the U.S. average. The Housing and Urban Development Agency's income limits were used to estimate growth in median household income from 2000 to 2006. Estimated median household income in Sublette County for 2006 was $59,400, an increase of 42 percent since 2000 (in 2000 dollars). Based on this estimate, Sublette County's median household income is now ranked fifth in the state (Sublette SE, 2006).

Table 3.5-9
A Comparison of Household and Per-Capita Income Statistics
for Southwestern Wyoming, and the United States in 2000

Parameter	Lincoln County	Sublette County	Sweetwater County	Wyoming	United States
Median household income	$40,794	$39,044	$46,537	$37,892	$41,994
Per capita income	$17,533	$20,056	$19,575	$19,134	$21,587
Families below the poverty line	6.4%	7.4%	5.4%	8.0%	9.2%
Individuals below the poverty line	9.0%	9.7%	7.8%	11.4%	12.4%
Source: U.S. Census Bureau, 2006.					

In 2004, the average wages per job in Sublette and Sweetwater counties exceeded the Wyoming average (Table 3.5-10). For the period 1999 to 2004, average wages per job increased 19.7 percent in Lincoln County, 29.7 percent in Sublette County, and 15.6 percent in Sweetwater County, compared with an 18 percent increase for Wyoming.

Table 3.5-10
Average Wages per Job, in 2004 Dollars,
for Lincoln, Sublette, and Sweetwater Counties, 1970 -2004

	1970	1980	1990	1999	2000	2001	2002	2003	2004
Lincoln County	$6,401	$15,130	$20,150	$24,456	$25,072	$25,931	$27,618	$30,120	$30,438
Sublette County	$5,897	$13,311	$17,628	$22,310	$24,697	$25,479	$27,756	$29,635	$31,715
Sweetwater County	$6,334	$18,933	$25,629	$32,648	$33,839	$35,654	$36,193	$37,382	$38,698
Wyoming	$6,070	$15,316	$19,844	$25,561	$26,602	$27,810	$28,838	$29,785	$31,179
Source: U.S. Dept. of Commerce, 2006.									

There is a group of individuals with unearned income (real dividends, interest, and rent) who reside in the three-county region. Some of these residents are retirees who have immigrated to the area. Figure 3.5-1 shows that there has been a slight decline in unearned income levels in the three-county region during the period 1999 to 2004, a trend which is more pronounced in Sweetwater and Lincoln counties than in Sublette County.

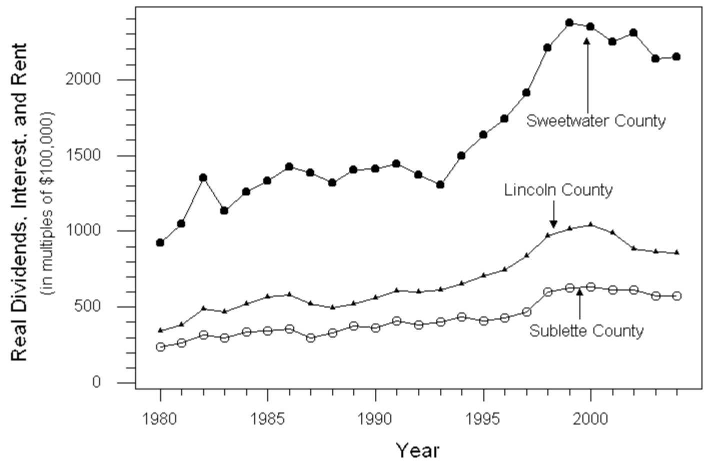


Figure 3.5-1
Real Dividends, Interest, and Rent in Lincoln, Sweetwater, and Sublette Counties for the period 1980-2004 (U.S. Dept. of Commerce, 2006)

The overall cost of living is 16 percent higher in Sublette County and 5 percent higher in Sweetwater County than in the rest of the State of Wyoming (Table 3.5-11). The overall cost of living in Sublette County is the second highest in Wyoming (behind Teton County), and the overall cost of living in Sweetwater County is the fourth highest in the state. The overall inflation rate for the southwestern region of Wyoming in the fourth quarter of 2005 was 8.3 percent, compared with 5 percent for Wyoming as a whole (Wyoming Department of Administration and Information, 2006a).

Table 3.5-11
A Comparison of Cost of Living Index Statistics for Southwestern Wyoming and the State of Wyoming in the Fourth Quarter, 2005[1]

County	All Items	Food	Housing	Apparel	Transportation	Medical	Recreation & Personal Care
Lincoln	90	88	83	98	101	86	107
Sublette	116	105	125	126	101	107	117
Sweetwater	105	97	112	92	101	107	95
Wyoming State Average	100	100	100	100	100	100	100

[1] an index value of 100 = the state average.
Source: Wyoming Department of Administration and Information, 2006a.

3.5.4 Growth in Economic Sectors

From 2001 to 2004, the mining sector in Lincoln County was the second fastest growing employer, growing at 56.9 percent, exceeded only by the education sector, which grew at 76.2 percent (Table 3.5-12). The industry with the fastest growing earnings was “Real estate and rental and leasing” (155.7 percent growth), followed by “Mining” (88.1 percent growth). The locus of most of the growth in Lincoln County’s real estate industry was Afton and the Star Valley in the northern part of the county. This area serves as a bedroom community for the tourism industry in neighboring Jackson Hole. It should be noted that this area is difficult to access from Pinedale and the PAPA because there are only secondary roads (not all-weather) traversing the Bridger-Teton National Forest.

In the North American Industry Classification System (NAICS) scheme, the category “Mining” includes oil and gas development and production. In 2004, “Oil and gas extraction” contributed $23.8 million or 42 percent, to the mining category; mining (except oil and gas) contributed $22.4 million, or 40 percent; and “Support activities for mining” contributed $10.1 million, or 18 percent in Lincoln County. Coal mining predominates in Lincoln County; the Pittsburg and Midway Coal Mining Company employs 297 workers (City of Kemmerer, 2006).

Sublette County’s economy as a whole grew faster than neighboring Sweetwater and Lincoln counties, with total industry earnings in the county growing by 57.2 percent in a 3-year period (Table 3.5-12). From 2001 to 2004, the mining sector was the fastest growing employer in Sublette County, increasing by 81.5 percent. The industry with the fastest growing earnings was “Agriculture” (242.7 percent growth), followed by “Mining” (111.4 percent growth), and “Real estate and rental and leasing” (100.5 percent growth). Even though the growth rate of earnings in agriculture led all others, employment in that sector decreased from 2001 to 2004. In terms of total earnings, the value of the mining sector (over $48 million) made it the largest industry in the county in 2004, comprising 28 percent of the county’s industry earnings (Table 3.5-12). In 2001, the category “Mining” (worth $22.8 million), was divided between the sub-categories “Oil and gas extraction” ($12.4 million) and “Support activities for mining” ($10.4 million). There was no mining activity other than oil and gas extraction reported for Sublette County. In 2004, the exact amount contributed to the category “Mining” by “Oil and gas extraction” was not reported; however, $28.3 million was reported as “Support activities for mining” (59 percent of the total reported for the category “Mining”).

Sweetwater County does not disclose industry earnings for the general NAICS category “Mining”, nor does it disclose industry earnings for the subcategory, “Oil and gas extraction.” In 2004, however, reported industry earnings for another subcategory, “Mining (except oil and gas) were $188.8 million, 12 percent more than in 2001. “Mining (except oil and gas)” is mostly trona mining with some coal mining in Sweetwater County. The subcategory, “Support activities for mining”, earned $143.5 million in 2004, up 48 percent from 2001. Among reported industry earnings, the fastest growing category for the period 2001 to 2004 was “Educational services” at 62.5 percent, followed by “Administrative and waste services” (27.7 percent), “Construction” (23.1 percent), and “Transportation and warehousing” (22.3 percent). The fastest growing employer was “Education services” (25.3 percent increase in 3 years), followed by “Arts, entertainment and recreation” (up 18.6 percent) and “Transportation and Warehousing” (up 18.1 percent).

Table 3.5-12
Changes in Employment and Industry Earnings in Lincoln, Sublette, and Sweetwater Counties from 2001 to 2004 by NAICS Sector Classification

NAICS Sector	County	Employment			Industry Earnings		
		2001	2004	Percent Change 2001-2004	2001 (thousands)	2004 (thousands)	Percent Change 2001-2004
Agriculture	Lincoln	675	668	-1.0	$3,204	$3,599	12.3
	Sublette	396	390	-1.5	$2,165	$7,420	242.7
	Sweetwater	198	195	-1.5	$703	$258	-136.7
Agricultural services	Lincoln	87	83	-4.6	$1,157	$1,175	1.6
	Sublette	78	80	2.6	$788	$874	10.9
	Sweetwater	ND	ND	-	ND	ND	-
Mining	Lincoln	436	684	56.9	$29,898	$56,241	88.1
	Sublette	432	784	81.5	$22,820	$48,235	111.4
	Sweetwater	ND	ND	-	ND	ND	-
Utilities	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	24	-	ND	$1,972	-
	Sweetwater	ND	ND	-	ND	ND	-
Construction	Lincoln	1,227	1,412	15.1	$41,152	$56,427	37.1
	Sublette	472	617	30.7	$13,868	$24,136	74.0
	Sweetwater	1,811	2,037	12.5	$72,985	$89,819	23.1
Manufacturing	Lincoln	403	362	-10.2	$12,879	$9,839	-23.6
	Sublette	ND	92	-	ND	$1,988	-
	Sweetwater	1,426	1,176	-17.5	$110,430	$107,864	-2.3
Wholesale trade	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	16	-	ND	$401	-
	Sweetwater	ND	ND	-	ND	ND	-
Retail trade	Lincoln	1,009	1,025	1.6	$14,026	$15,850	13.0
	Sublette	442	484	9.5	$8,455	$9,545	12.9
	Sweetwater	2,928	3,038	3.8	$56,203	$64,357	14.5
Transportation and warehousing	Lincoln	220	215	-2.3	$10,030	$8,614	-14.1
	Sublette	81	112	38.3	$2,982	$3,438	15.3
	Sweetwater	1,111	1,312	18.1	$56,599	$69,207	22.3
Information	Lincoln	125	172	37.6	$3,387	$4,752	40.3
	Sublette	51	48	6.3	$1,132	$1,466	29.5
	Sweetwater	258	260	0.8	$6,334	$7,542	19.1
Finance and insurance	Lincoln	224	255	13.8	$7,237	$6,226	-14.0
	Sublette	81	118	38.3	$2,204	$4,033	83.0
	Sweetwater	540	571	5.7	$16,917	$19,324	14.2
Real estate and rental and leasing	Lincoln	324	382	17.9	$4,545	$11,621	155.7
	Sublette	175	194	10.9	$2,378	$4,767	100.5
	Sweetwater	675	761	12.7	$27,910	$31,354	12.3

NAICS Sector	County	Employment			Industry Earnings		
		2001	2004	Percent Change 2001-2004	2001 (thousands)	2004 (thousands)	Percent Change 2001-2004
Professional and technical services	Lincoln	231	293	26.8	$5,353	$6,849	27.9
	Sublette	237	248	4.6	$8,715	$9,874	13.3
	Sweetwater	616	678	10.1	$24,655	$29,499	19.6
Management of companies and enterprises	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	90	104	15.6	$4,613	$6,003	30.1
Administrative and waste services	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	799	879	10.0	$15,731	$20,083	27.7
Educational services	Lincoln	21	37	76.2	ND	$88	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	91	114	25.3	$769	$1,250	62.5
Health care and social assistance	Lincoln	ND	ND	-	ND	ND	-
	Sublette	ND	ND	-	ND	ND	-
	Sweetwater	1,196	1,298	8.5	$32,770	$37,646	14.9
Arts, entertainment, and recreation	Lincoln	124	138	11.3	$2,607	$3,354	28.7
	Sublette	95	127	33.7	$2,379	$3,324	39.7
	Sweetwater	284	337	18.6	$3,453	$4,167	20.7
Accommodations and food services	Lincoln	585	590	0.9	$5,227	$5,087	-2.7
	Sublette	386	450	16.9	$5,051	$6,810	34.8
	Sweetwater	2,102	2,295	9.2	$27,564	$32,539	18.0
Other services, except public administration	Lincoln	376	416	10.6	$4,702	$6,033	28.3
	Sublette	211	250	18.5	$2,434	$3,036	24.7
	Sweetwater	1,062	1,104	4.0	$19,683	$22,195	12.7
Government and government enterprises	Lincoln	1,556	1,633	4.9	$49,088	$61,808	25.9
	Sublette	702	803	14.4	$24,248	$32,783	35.2
	Sweetwater	4,210	4,209	0.0	$145,276	$171,218	17.9
TOTAL	**Lincoln**	**8,434**	**9,292**	**10.2**	**$221,637**	**$293,624**	**32.5**
	Sublette	**4,251**	**4,704**	**10.7**	**$108,944**	**$171,298**	**57.2**
	Sweetwater	**24,493**	**26,033**	**6.3**	**$984,951**	**$1,171,791**	**19.0**

Source: U.S. Department of Commerce, 2006.
Notes: All data include self-employed workers, ND = non-disclosure.

A profile of jobs covered by unemployment insurance, which estimates the rate of change in employment in Lincoln, Sublette, and Sweetwater counties from 2001 to 2005 (Table 3.5-13), indicates a robust growth rate of 52.5 percent in total employment in Sublette County, with 95.5 percent growth in natural resource and mining jobs. During that period, there was moderate job growth in Sweetwater County, with natural resource and mining jobs leading the pace at 34.8 percent growth, and slow overall job growth in Lincoln County but rapid growth in natural resource and mining jobs of 49.2 percent (U.S. Department of Labor, 2006).

Table 3.5-13
Employment in Lincoln, Sublette, and Sweetwater Counties from 2001 to 2005

Year	County	Total Jobs	Percent Change in Total Jobs	Natural Resource and Mining Jobs	Percent Change in Natural Resource and Mining Jobs
2001	Lincoln	5,757	N/A	445	N/A
	Sublette	2,617	N/A	445	N/A
	Sweetwater	18,876	N/A	3,610	N/A
2002	Lincoln	5,734	0.0	482	8.3
	Sublette	2,790	6.6	468	5.2
	Sweetwater	18,934	0.0	3,430	-0.1
2003	Lincoln	6,643	15.9	621	28.8
	Sublette	3,088	10.7	694	48.3
	Sweetwater	19,862	4.9	3,697	7.8
2004	Lincoln	5,981	-10.0	674	8.5
	Sublette	3,357	8.7	736	6.1
	Sweetwater	20,825	4.8	4,266	15.4
2005 (projected)	Lincoln	5,936	0.0	664	-1.5
	Sublette	3,992	18.9	870	18.2
	Sweetwater	22,218	6.7	4,866	14.1
Total From 2001 to 2005	**Lincoln**	**+179**	**3.1**	**+219**	**49.2**
	Sublette	**+1,375**	**52.5**	**+425**	**95.5**
	Sweetwater	**+3,342**	**17.7**	**+1,256**	**34.8**

Source: U.S. Department of Labor, 2006.
Note: These data include only jobs covered by unemployment insurance. August employment rates are higher than any other month of the year in southwestern Wyoming.

3.5.5 Housing

The U.S. Census Bureau estimates that between 2000 and 2004, the number of housing units increased by 10.8 percent in Lincoln County, 8.6 percent in Sublette County, and 1.0 percent in Sweetwater County. This compares to a 3.9 percent increase in Wyoming for the same period (Table 3.5-14). Growth in population has outpaced growth in housing in Sublette County for the period 2000-2005 (Sublette SE, 2006).

From 2000 to 2005, the cost of renting an apartment increased substantially in southwestern Wyoming (Table 3.5-15). Analyses of housing affordability suggest that it may be prohibitively expensive for those employed in the PAPA to move to the three-county region (Sublette SE, 2006). The increase was 61 percent for Sublette County, 55 percent for Lincoln County, and 40 percent for Sweetwater County (Table 3.5-15). During this same period, the cost of renting a house increased in Sublette County (41 percent) and Sweetwater County (39 percent) but decreased in Lincoln County (13 percent). The cost of renting a mobile home lot from 2000 to 2005 increased 37 percent in Sublette County, 13 percent in Lincoln County, and 9 percent in Sweetwater County. The rate of increase for renting a mobile home on a lot was even higher. Increases for 2000 to 2005 were 53 percent in Sweetwater County, 36 percent in Sublette County, and 20 percent in Lincoln County. A comparison between cost of living statistics in Lincoln, Sublette, Sweetwater, and the other 20 counties was included in the Jonah Infill Drilling FEIS (BLM, 2006a).

Table 3.5-14
Housing Unit Estimates in Lincoln, Sublette, and Sweetwater Counties and Wyoming for 2000-2004

Value	Lincoln County		Sublette County		Sweetwater County		Wyoming	
	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000	Housing Units	Percent Change from 2000
2000 Census	6,831	N/A	3,552	N/A	15,921	N/A	223,854	N/A
2001 Estimate	7,012	2.65	3,620	1.91	15,995	0.46	225,961	0.94
2002 Estimate	7,220	5.69	3,693	3.97	16,026	0.66	227,780	1.75
2003 Estimate	7,408	8.45	3,773	6.22	16,045	0.78	229,663	2.59
2004 Estimate	7,571	10.83	3,859	8.64	16,078	0.99	232,637	3.92
Source: U.S. Census Bureau, 2006.								

Table 3.5-15
Lincoln, Sublette, and Sweetwater Counties Average Rental Housing Costs from 2000 to 2005

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
2nd Quarter, 2000	Lincoln	$245	$466	$158	$311
	Sublette	$433	$624	$175	$435
	Sweetwater	$367	$485	$196	$389
4th Quarter, 2000	Lincoln	$277	$417	$195	$317
	Sublette	$464	$566	$165	$435
	Sweetwater	$333	$498	$196	$401
2nd Quarter, 2001	Lincoln	$295	$464	$175	$330
	Sublette	$455	$608	$165	NR
	Sweetwater	$368	$534	$200	$439
4th Quarter, 2001	Lincoln	$292	$400	$158	$315
	Sublette	$441	$613	$175	$350
	Sweetwater	$390	$533	$201	$422
2nd Quarter, 2002	Lincoln	$285	$441	$163	$328
	Sublette	$472	$611	$200	NR
	Sweetwater	$387	$518	$202	$443
4th Quarter, 2002	Lincoln	$332	$388	$163	$304
	Sublette	$534	$655	$165	$457
	Sweetwater	$392	$516	$197	$422
2nd Quarter, 2003	Lincoln	$414	$534	$157	$403
	Sublette	$520	$769	$200	$472
	Sweetwater	$391	$539	$208	$449
4th Quarter, 2003	Lincoln	$421	$433	$183	$315
	Sublette	$611	$794	$200	NR
	Sweetwater	$412	$595	$218	$457

Quarter, Year	County	Apartment	House	Mobile Home Lot	Mobile Home on a Lot
2nd Quarter, 2004	Lincoln	$347	$382	$163	$300
	Sublette	$647	$808	$225	$624
	Sweetwater	$427	$635	$212	$566
4th Quarter, 2004	Lincoln	$364	$387	$168	$312
	Sublette	$765	$888	$240	$600
	Sweetwater	$469	$654	$212	$546
2nd Quarter, 2005	Lincoln	$379	$407	$178	$374
	Sublette	$699	$882	$240	$590
	Sweetwater	$512	$673	$214	$594
Source: Wyoming Department of Administration and Information, 2006a.					

The Wyoming Rental Vacancy Survey is administered and analyzed semiannually by the Wyoming Housing Database Partnership (Table 3.5-16). Vacancy rates are extrapolated based on a sampled population each June or July (denoted 'a') and December (denoted 'b'). The data show some seasonality in vacancy rates, with tighter rental markets in June/July than in December, although these trends were less pronounced in Sublette and Sweetwater counties in 2004 and 2005. In December 2005, Sweetwater County had the tightest rental market in the three-county region, with a vacancy rate of 2.4 percent, followed by Sublette County (4.6 percent) and Lincoln County (10.2 percent). The vacancy rate for Sublette County in the first period of 2006 was estimated at 1.89 percent (Allen, 2006). It is noteworthy that in Sublette County in 2000, there were 930 housing units that were vacant for seasonal use, compared to seven available in the second half of 2005 (U.S. Census Bureau, 2006).

Table 3.5-16
Semiannual (Year with a and b) Rental Vacancy Survey
for Lincoln, Sublette, and Sweetwater Counties from 2001 to 2005

Year	County	Sample	Total Units	Vacant Units	Percent Vacancy Rate
2001a	Lincoln	13	287	26	9.0
	Sublette	4	41	2	4.9
	Sweetwater	16	821	67	8.2
2001b	Lincoln	9	132	19	14.4
	Sublette	2	39	NR	NR
	Sweetwater	19	1,083	49	4.5
2002a	Lincoln	8	114	10	8.8
	Sublette	3	41	NR	NR
	Sweetwater	20	1,060	65	6.1
2002b	Lincoln	7	151	22	14.6
	Sublette	5	37	2	5.4
	Sweetwater	21	1,439	65	4.5
2003a	Lincoln	7	106	7	6.6
	Sublette	7	50	2	4.0
	Sweetwater	24	1,620	34	2.1
2003b	Lincoln	11	201	11	5.5
	Sublette	6	55	2	3.6
	Sweetwater	19	1,083	49	4.5
2004a	Lincoln	9	176	12	6.8
	Sublette	6	59	1	1.7
	Sweetwater	29	1,369	12	0.9

Year	County	Sample	Total Units	Vacant Units	Percent Vacancy Rate
2004b	Lincoln	8	270	46	17.0
	Sublette	9	75	4	5.3
	Sweetwater	28	1,264	20	1.6
2005a	Lincoln	10	208	14	6.7
	Sublette	12	96	4	4.2
	Sweetwater	24	1,440	34	2.4
2005b	Lincoln	14	137	14	10.2
	Sublette	13	154	7	4.6
	Sweetwater	27	923	22	2.4
Source: Wyoming Housing Database Partnership, 2006.					

There is pressure on the housing rental market in the three-county region. Lincoln County has fewer rental units than Sublette or Sweetwater County; in 2002, 20 percent of its rental properties were vacant (1,349 units), probably due to growth in second-home ownership in the county (BLM, 2006a). In 2002, Sublette County had both the highest, officially-reported, vacancy rate in the three-county region (32 percent, 1,155 vacant units) and the least owner-occupied units (50 percent). There is a shortage of available housing in Sublette County according to the Sublette County Assessor's Office (BLM, 2006a). Furthermore, due to housing shortages in northern Sublette County, market demand is pushing up prices of current homes on the market. Numerous temporary housing projects and significant increases in construction of permanent housing in Sublette County have occurred (BLM, 2006a). An August 2006 plan to build a man camp in Farson (Lincoln County) was fought and defeated by local residents (Gearino, 2005). According to officially reported statistics, the housing market in Sweetwater County is the tightest in the three-county region (BLM, 2006a). Gearino (2005) attributed this phenomenon to the scarcity, and corresponding expensive housing in Sweetwater County.

The market is responding to increased demand for housing in the three-county area. Building permits and per-unit valuation of new construction have trended up from 2000 to 2005 in all three counties in southwestern Wyoming (Table 3.5-17). In Sublette and Sweetwater counties, the median sale prices of single-family homes have also trended up, at a pace exceeding the state wide trends (Sublette SE, 2006).

Table 3.5-17
Building Permits and Valuation, Lincoln, Sublette, and Sweetwater Counties from 2000 to 2005

Year	County	Authorized construction in permit issuing areas					Per-unit valuation, 1000s of real 2005 dollars
		Single-family Units	Duplex Units	Tri- and Four-plex Units	Multi-family Units	Total Units	Single-family Units
2000	Lincoln	145	0	0	0	145	150.61
	Sublette	54	0	0	0	54	146.40
	Sweetwater	36	0	0	5	41	150.42
2001	Lincoln	214	0	4	0	218	153.66
	Sublette	72	4	0	0	76	153.34
	Sweetwater	38	0	0	0	38	183.72
2002	Lincoln	192	0	4	8	204	157.70
	Sublette	74	6	8	0	88	160.51
	Sweetwater	48	0	0	0	48	165.76
2003	Lincoln	180	0	0	0	180	167.15
	Sublette	83	4	8	0	95	161.94
	Sweetwater	63	0	0	0	63	187.21

Year	County	Authorized construction in permit issuing areas					Per-unit valuation, 1000s of real 2005 dollars
		Single-family Units	Duplex Units	Tri- and Four-plex Units	Multi-family Units	Total Units	Single-family Units
2004	Lincoln	206	2	4	0	212	166.44
	Sublette	77	12	4	0	93	175.52
	Sweetwater	216	0	0	0	216	164.54
2005	Lincoln	229	6	0	0	235	158.58
	Sublette	99	0	0	0	99	173.17
	Sweetwater	203	0	0	0	203	145.03
Source: U.S. Census Bureau, 2006 and Wyoming Housing Database Partnership, 2006.							

3.5.6 Infrastructure

The three-county region covers 19,469 square miles (4,089 square miles in Lincoln County, 4,883 square miles in Sublette County, and 10,497 square miles in Sweetwater County). Sweetwater County is transected east and west by Interstate 80. Rock Springs and Green River are located 19 miles apart on I-80. Pinedale is located 100 miles northwest of Rock Springs on U.S. Highway 191. Kemmerer is located 70 miles northwest of Green River on U.S. Highway 30.

3.5.6.1 Transportation

Rock Springs is serviced by two commercial airlines providing daily flights to and from Denver International Airport. Kemmerer is serviced by one commercial airline providing daily flights to and from Salt Lake City International Airport. Sublette County is serviced by two private airports. Alpine and Afton are each serviced by one private airport. Rock Springs is also serviced by two bus lines, four car rental services and two taxi services.

3.5.6.2 Fire Protection Services

Fire protection is provided by four fire departments in Lincoln County, three fire departments in Sublette County, and ten in Sweetwater County (Capitol Impact, 2006). The 24-member Pinedale Volunteer Fire Department (PVFD) serves the PAPA (Mitchell, 2006). They purchased a new rescue truck in 2003 with town funds (drawing on tax revenues from the PAPA). The fire-fighting emergency response capabilities have been adequate to meet demands from the PAPA to date (Mitchell, 2006). A hazardous materials trailer was recently purchased for the PAPA, and they began using it during summer 2006. The Operators are responsible for responding to fires that may occur in the PAPA, while the PVFD would maintain a buffer perimeter around the fire (Mitchell, 2006).

3.5.6.3 Law Enforcement

First-call police services to the PAPA are provided by the Sublette County Sheriff's Department. Sublette County is the only county in the state that has sheriff services with no local police services. Since 2000, the Sheriff's office has added eight officers, including detectives. There are currently 23 officers in Sublette County. They are currently trying to add a few more officers to handle vacancies, mostly created due to officers who are in the military reserves. A major challenge facing the Sheriff's office is difficulty in keeping officers and other staff members, because wages and benefits paid by the oil and gas operators are higher than what the County pays (Hanson, 2006a). Sublette County Commissioners are sensitive to this issue and are working to raise wages. The Sheriff department's current staffing is adequate to handle county traffic control including drunken driving issues. They are able to run more patrols of oil fields and have greater visibility in the community than they had prior to 2000. The PAPA does not pose as difficult a patrolling challenge as the Jonah Field Project Area because the PAPA is closer to Pinedale. The Sheriff's Department is well-supported and equipped to meet its current responsibilities (Hanson, 2006a).

Law enforcement providers in Sweetwater and Lincoln counties have also felt the effects of growth in the PAPA. According to McConkie (2006), the Kemmerer Police Department has experienced increased demand for police services since 2000 due to growth in oil and gas activity. The City has responded by providing budget increases to pay for additional officers to keep up with the demands. In the City of Rock Springs, the police department has noticed an increase in oil and gas personnel who work in the PAPA but live and recreate in Sweetwater County (Kessler, 2006). In addition to a rise in index crimes (Sublette SE, 2006), there are increases in smaller crimes –such as drunkenness in public and traffic control issues – which require a large portion of officer's time. Recent data indicate that index crimes increased more than historical data would have predicted (Sublette SE, 2006). Rock Springs recently received approval to add six officers to their current roster of 44, but finding individuals and providing adequate training has proved difficult (Kessler, 2006). Of the 44 officers on payroll, 38 operate independently on patrol.

Drug use, in particular methamphetamine use, is an increasingly difficult and prevalent problem in the three-county region. Southwest Counseling Service in Rock Springs is the drug treatment facility that serves southwestern Wyoming (Schmid, 2006). In fiscal year 2003-2004, the number of diagnoses made for methamphetamine dependence exceeded the number of alcohol dependence diagnoses for the first time in the agency's history. Eighty percent of arrests in Sweetwater County are associated with methamphetamine use (Schmid, 2006). The Wyoming legislature has responded to the methamphetamine problem with additional laws and funding. In 2005, $9 million were allocated for community efforts to combat methamphetamine distribution and addiction.

3.5.6.4 Medical Services

The first call emergency medical services to the PAPA are provided by the Sublette Rural Health Care District (McGinnis, 2006). In 1999, the District's emergency medical crews were volunteers. The District has paid staff members comprising two crews with 24-hour coverage, including two crews from 5:00 a.m. till 8:00 p.m. There is more demand for services from Memorial Day to Labor Day and, accordingly, they add personnel. The District has six ambulances, all with four-wheel drive vehicles. They are currently constructing a four-bay ambulance barn in Pinedale and another two-bay barn in Sand Draw, closer to the PAPA. The emergency medical technicians are all highly trained. The District is fully staffed and equipped to meet emergency demands (McGinnis, 2006). The District and the Pinedale Clinic send dozens of referrals per week to the Memorial Hospital in Rock Springs (Belltran, 2006). Trauma victims from the PAPA are transported to hospitals in Salt Lake City by helicopter using Memorial Hospital resources. There has not been an increase in trauma incidents in the period 2000-2005 and they are equipped to meet the current demand. Most of the referrals from the PAPA to Memorial Hospital are broken bones, bruises, and lacerations. Memorial Hospital is not experiencing strain on its emergency services provision (Belltran, 2006).

In Lincoln County, two medical centers coordinate primary and urgent-care services. The South Lincoln Medical Center has a 16-bed hospital facility which provided 1,023 patient-days of care in 2005. There were 16,352 clinic visits and 2,439 emergency room visits in 2004 (up from 2,039 emergency room visits in 2003). There are two satellite clinics, two family practice physicians, one physician's assistant, and one family nurse practitioner located in the southern part of the county. In the northern part of the county, the Star Valley Medical Center has a 24-

bed hospital facility. There are six independent physicians in Afton, and in Alpine there is one clinic staffed by a family nurse practitioner. There are two nursing homes in Lincoln County.

In Sublette County, medical services include a clinic with two branches, two independent physicians, a physician's assistant, one dentist, ambulance service, and a nursing home with 107 rooms. The Pinedale Medical Clinic serviced approximately 13,203 patients in 2005 (Sublette County Rural Health Care District, 2006), up 9 percent from 12,000 patients in 2003 (BLM, 2006c). The Marbleton-Big Piney Clinic serviced approximately 6,000 patients in 2005 (Sublette County Rural Health Care District, 2006).

The main center for medical services in Sweetwater County is the Memorial Hospital in Rock Springs, with a 99-bed hospital facility that, in 2005, provided 22,000 days of emergency room care, 2,900 days of in-patient care, and 2,400 days of out-patient care. Memorial Hospital coordinates emergency care services for southwestern Wyoming. There are 40 consulting physicians affiliated with the hospital. Seven dentists practice in Rock Springs. In Green River, the Castle Rock Medical Center coordinates care with four physicians and four physician's assistants. There are three nursing homes in Sweetwater County.

3.5.6.5 Lodging

Hotel and motel accommodations in Lincoln County include sixteen hotels and motels with 350 rooms, three guest ranches, and one bed and breakfast. In Sublette County there are 23 hotels and motels, with a total of 629 rooms, three RV parks totaling 83 spaces, three bed and breakfasts, and 11 guest ranches. In Sweetwater County there are five convention facilities (with a total capacity of 4,660 persons), 31 hotels/motels (1,680 total rooms), an RV park (50 spaces), and several mobile home parks.

3.5.6.6 Libraries

Each county has a library system. The Lincoln County Public Library has four branches with 112,452 volumes total. The Sublette County Public Library has two branches with 80,000 volumes total. The Sweetwater County Public Library has nine branches with 207,000 volumes total.

3.5.6.7 Schools

There are five school districts in the three-county region. Table 3.5-18 shows trends in school enrollments, 2000-2005, in the three-county region. Schools in Sublette County and Sweetwater CSD (Consolidated School District) #1 are experiencing increased enrollments, whereas in Lincoln County and Sweetwater ISD (Independent School District) #2 are experiencing declining enrollments.

Lincoln County has recently closed one elementary school but it could be reopened. Two of their buildings are seismically unsound and will be rebuilt; based on current projections, they are not being built with room to expand (Chaulk, 2006).

Sweetwater County ISD #2 (Green River) has recently closed three elementary schools. Even with these closures, they have capacity for 100 additional elementary school students. Green River High School was built in 1996 for 1,400 students; with a current enrollment of 693, they have considerable room for expansion in the 7th through 12th grades (Van Mater, 2006). Sweetwater CSD #1 (Rock Springs) has seen recent increases in numbers of kindergarten through 6th grade students. They are not at capacity in their elementary schools but they are approaching it. They will be building a new kindergarten through 6th grade building in 3 years. They have plenty of capacity to expand in their 7th through 12th grade schools. There were 980 high school students enrolled at the end of the 2005-2006 school year in a building that held 1,200 students in the 1990s (Lopiccolo, 2006).

Table 3.5-18
Trends in School Enrollment in Lincoln, Sublette, and Sweetwater Counties from 2000 to 2005

	10/1/2000	10/1/2001	10/1/2002	10/1/2003	10/1/2004	10/1/2005
Lincoln #1	789	724	668	669	622	628
Sublette #1	639	630	671	689	701	763
Sublette #9	569	587	571	592	591	617
Sweetwater #1	4,665	4,401	4,264	4,193	4,197	4,240
Sweetwater #2	2,928	2,774	2,688	2,650	2,620	2,581
Source: Wyoming Department of Administration and Information, 2006b.						

Both Sublette County CSDs report effects on their enrollments from the development in the PAPA (Anschutz, 2006 and McAdams, 2006). Sublette CSD #1 is constrained for space in the middle school; they are currently building a second middle school, which will accommodate grades 5 and 6. Elementary schools are constrained for space; they will need to build a new elementary school within 5 years. The high school has space to expand. There were 232 enrolled at the end of the 2005-06 school year, and they expect 260 students for 2006-2007, but up to 300 could be accommodated (McAdams, 2006). Sublette CSD #2 has experienced no growth in middle school or high school enrollments but is seeing growth in elementary school populations. They are short of space in their elementary school buildings (Anschutz, 2006).

3.5.6.8 Communications

Communications in the three-county region consist of three weekly newspapers in Lincoln County, two weekly newspapers in Sublette County, and one weekly and one daily newspaper in Sweetwater County. In Lincoln County there are two radio stations, in Sublette County there are two radio stations, and in Sweetwater County there are six radio stations.

3.5.7 County and Local Government Revenues

A foundational source of revenue for the three-county region is sales taxes. All Wyoming counties have levied sales taxes since 1935. Lincoln County levies a 5 percent sales tax (4 percent is paid to the State; 1 percent is retained by the county). Kemmerer levies a 2 percent lodging tax. In 2005, sales tax collections from mining production ($2.3 million) represented 16 percent of total collections for Lincoln County ($14.7 million). Sales tax in Sublette County is 4 percent with a 3 percent lodging tax. In 2003, the largest source of sales tax revenue for Sublette County was from mining (51 percent). This markedly differs from the rest of Wyoming, where retail sales account for 45 percent of sales tax revenue. In Sublette County, 14 percent of sales tax revenues were from retail sales, 13 percent from services, and 12 percent from wholesale sales. Sales tax in Sweetwater County is 5 percent (4 percent is paid to the state; 1 percent is paid to Sweetwater County). Sweetwater County levies a 2 percent lodging tax. In 2005, sales tax collection from mining production ($9.2 million) represented 18 percent of total collections for Sweetwater County ($50.4 million). This represents sales tax collection on sales by the mining sector, not the sales tax paid by the mining industry.

Assessed valuation is the basis for levying property taxes and mineral severance taxes (Table 3.5-19). The 2005 assessed valuation in Sublette County was $2.9 billion, a six-fold increase since 2000. County revenues from mineral severance taxes and property taxes on oil and gas development in the PAPA, which are returned to the local government, are paid to Sublette County and its municipalities.

The federal government owns and manages 49 percent of land in Wyoming; including 75 percent of Lincoln County, 67 percent of Sublette County, and 69 percent of Sweetwater County. Federal lands are not subject to property taxes that support county governments and education. Since 1976, Congress has authorized federal land management agencies to share income with states and counties through its Payment In Lieu of Taxes (PILT) program. In 2005, in Lincoln County, $757,883 was returned to the county on 1,947,047 acres enrolled in the PILT program, an effective payment of $0.39 per entitlement-acre. In 2005 in Sublette County, $481,089 was returned to the county on 2,431,287 acres enrolled in the PILT program, an effective payment of $0.198 per entitlement-acre. In 2005 in Sweetwater County, $1,624,031 was returned to the county on 4,611,015 acres enrolled in the PILT program, an effective payment of $0.35 per entitlement-acre (Foulke et al., 2006a).

Sublette County and its municipalities receive three types of tax revenues based on oil and gas production in the PAPA: ad valorem taxes, severance taxes, and federal mineral royalties. Tax revenues for ad valorem and severance taxes are based on the previous year's production (Table 3.5-19).

Table 3.5-19
Production and Sales of Oil and Gas from the PAPA Natural Gas Wells used to Estimate Revenues

Source	2000	2001	2002	2003	2004	2005
Production[1]						
Gas (MSCF)	8,195,121	14,946,294	41,909,699	80,504,011	136,,329,573	179,160,224
Oil (Bbls)	78,621	143,378	376,726	649,687	1,075,210	1,407,162
Sales/production Ratio[2]						
Gas	88.2%	88.2%	88.2%	88.2%	88.2%	88.2%
Oil	100%	100%	100%	100%	100%	100%
Sales:						
Gas (MSCF)	7,231,375	13,188,610	36,981,118	71,036,739	120,297,215	158,090,982
Oil (Bbls)	78.621	143,378	376,726	649,687	1,075,210	1,407,162

[1] Tax revenue for ad valorem and severance taxes is based on the previous year's production.
[2] Source: Wyoming Department of Revenue, 2006 and WOGCC, 2006.

A severance tax is an excise tax imposed on removing, extracting, severing, or producing any mineral in Wyoming. An ad valorem tax is a tax on property which also applies to minerals in Wyoming. Estimated ad valorem and severance tax distributions to Sublette County from PAPA natural gas wells, from 2000 to 2005, are presented in Table 3.5-20. These ad valorem and severance taxes are paid to the State School Foundation Program (12 mills), and to Sublette County and its school districts.

A mineral royalty is the amount of money paid to the owner of the mineral resource by the mineral producer. Wyoming receives a base royalty of 16.7 percent of the value of production from state-owned minerals. The federal government receives a royalty of 12.5 percent of the value of production for federally-owned minerals. Federal mineral royalties (FMR) paid to the State of Wyoming from PAPA natural gas wells are shown in Table 3.5-21. Fifty percent of FMR are returned to the state, and a portion of that is then distributed to counties and towns. In 2005, Pinedale received $150,000 in federal mineral royalties; Marbleton received $84,000; and Big Piney received $54,000 (Lummis et al., 2005).

Table 3.5-20
Estimated Ad Valorem and Severance Tax Distributions to Sublette County from PAPA Natural Gas Wells from 2000 to 2005

Source	2001	2002	2003	2004	2005
Ad valorem taxes					
Rate[1] on gas per MSCF	$0.18	$0.10	$0.20	$0.25	$0.30
Rate[1] on oil per Bbls	$1.27	$1.34	$1.60	$2.11	$2.55
Ad valorem – Gas	$233,950	$3,698,112	$14,207,348	$30,074,304	$47,862,045
Ad valorem – Oil	$182,090	$504,813	$1,039,499	$2,268,693	$3,586,687
Ad valorem – Total	$2,556,040	$4,202,925	$15,246,847	$32,342,997	$51,448,732
Severance taxes					
Rate[1] on gas per MSCF	$0.15	$0.09	$0.18	$0.23	$0.29
Rate[1] on oil per Bbls	$1.11	$1.22	$1.52	$1.95	$2.19
Severance – Gas	$1,995,437	$3,324,603	$13,013,931	$28,017,221	$46,162,567
Severance – Oil	$159,322	$458,589	$984,731	$2,096,552	$3,081,685
Severance – Total	$2,154,758	$3,783,191	$13,998,661	$30,113,773	$49,244,251
[1] Source: Wyoming Department of Revenue, 2006.					

Table 3.5-21
Federal Mineral Royalties (FMR) to Wyoming from PAPA Natural Gas Wells

Source	2001	2002	2003	2004	2005
Rate[1] on gas per MSCF	$0.30	$0.12	$0.20	$0.16	$0.25
Rate1 on oil per Bbls	$1.41	$0.99	$1.33	$1.54	$1.84
FMR – Gas	$3,982,960	$4,604,149	$14,491,495	$19,307,703	$39,522,745
FMR- Oil	$201,876	$374,277	$861,160	$1,656,899	$2,594,807
FMR- Total	$4,184,836	$4,978,427	$15,352,655	$20,964,602	$42,117,552
[1] Mineral Management Services, 2005					

3.5.8 Natural Gas Prices

Increases in natural gas prices are one factor influencing Operator's decisions regarding the number of wells to drill and the level of production from existing wells. From 2000 to 2005, the average wellhead price paid for Wyoming natural gas has increased (Table 3.5-22).

Table 3.5-22
Average Prices Paid at the Wellhead, in Wyoming 2000 to 2005

Year	Price $/MCF
2000 annual average	$3.42
2001 annual average	$3.66
2002 annual average	$2.09
2003 annual average	$4.41
2004 annual average	$5.17
2005 Year to Date	$4.75
Source: DeBruin, 2005.	

3.6 TRANSPORTATION

3.6.1 Development Within the PAPA

The primary routes to, and main access through, the PAPA are U.S. Highway 191 and State Highway 351, respectively (see Map 2.3-2 in Chapter 2). Before issuance of the PAPA ROD (BLM, 2000b), access within the PAPA was limited to a few county roads, BLM roads, oil and gas roads, and a number of two-track roads. Numerous local and resource roads have been constructed throughout the PAPA in conjunction with natural gas development since issuance of the PAPA ROD. Most collector roads existing prior to issuance of the PAPA ROD have been upgraded and/or expanded, and one new collector road has been constructed (North Anticline Road).

Table 3.6-1 provides length of roads and acreage of disturbance for roads within the PAPA. Collector roads provide primary access in the PAPA and generally receive the highest traffic volume of the three classes. Local roads provide access to multiple well locations while resource roads provide access to individual well locations and receive the lowest traffic volume. Lengths and acreage of disturbance include collector roads existing before issuance of the PAPA ROD (BLM, 2000b) that have been subsequently upgraded and expanded.

Table 3.6-1
Existing Wellfield Roads Within the PAPA by Road Category

	Existing Roads as of December 2005		Roads Proposed in 2006		Total Existing Wellfield Related Roads	
Category	Length (miles)	Area (acres)	Length (miles)	Area (acres)	Length (miles)	Area (acres)
Collector	66.7	419.0	0.00	0.00	66.7	419.0
Local	68.7	324.1	5.9	30.7	148.4	693.4
Resource	73.8	338.6				
Total	209.2	1,081.7	5.9	30.7	215.1	1,112.4

3.6.1.1 Traffic Volume

Vehicle traffic volumes within and adjacent to the PAPA have increased since 2000. For example, daily traffic on State Highway 351 was estimated at 640 vehicles per 24 hours (with 110 trucks per 24 hours) in 2000. By 2005, traffic volume had more than doubled to 1,450 vehicles per 24 hours, while truck traffic more than tripled to 380 trucks per 24 hours (Wyoming Department of Transportation – WDOT, 2005). Likewise, traffic on U.S. Highway 191, measured near the junction with Wenz Airport Road, increased from 1,700 vehicles per 24 hours (180 trucks per 24 hours) in 2000 to 2,640 vehicles per 24 hours (330 trucks per 24 hours) in 2005 (WDOT, 2005). Table 3.6-2 summarizes average vehicles per day estimated for different road sections near the PAPA in 2000 and in 2005.

According to WDOT (Roadifer, 2006), all sections of U.S. Highway 191 are rated Level of Service C based upon current traffic volumes. In WDOT's 2005 analysis of U.S. Highway 191, there was an increase of 58 percent of overall traffic with a 90 percent increase in truck traffic between 2002 and 2005. The volume increase caused the downgrade to a Level of Service C. Similar analysis has not been done by WDOT for State Highway 351. WDOT tries to maintain all roads at a Level of Service C or higher. Anything below a Level of Service C would necessitate road improvements (Roadifer, 2006).

Table 3.6-2
Average Number of Vehicles Per Day on Highways Used to Access the PAPA

Section Description	Section Milepost		Pre-ROD (July 2000)		Post-ROD (December 2005)	
	Begin	Length (miles)	All Vehicles	Trucks	All Vehicles	Trucks
U.S. Highway 191						
Sweetwater – Sublette County Line	51.62	21.33	1,500	240	2,920	640
Jct. Speedway Road	72.81	3.95	1,500	240	2,770	630
Jct. Route 1801 (WY 351)	76.75	7.75	1,300	160	1,910	270
Jct. Fish Hatchery Road	84.50	3.30	1,200	150	2,050	280
Jct. Route 1804 (WY 353)	87.80	4.99	1,600	170	2,450	310
Jct. Wenz Airport Road	92.80	2.70	1,700	180	2,640	330
Jct. County Road 221 East & West	95.50	3.00	1,800	190	3,260	360
Jct. County Road 121 East	98.50	0.49	1,900	210	3,970	380
Pinedale South Corp Limits	98.99	0.40	3,100	230	4,510	360
Jct. Fremont Lake Road	99.39	0.89	4,600	240	5,670	360
Pinedale West Corp Limits	100.27	0.76	3,000	230	5,330	340
Jct. County Road 144 North	101.03	4.51	2,400	240	3,600	320
Jct. Route 352 (WY 352)	105.54	4.93	1,900	230	2,370	210
State Highway 351						
Jct. Route 11 (U.S. 189)	0	12.91	640	110	1,450	380
Jct. County Road 136 North	12.91	11.27	280	40	1,070	360
Jct. Route 13 (U.S. 191)	0	6.70	400	50	650	30
Source: WDOT, 2005.						

Comparable traffic volume data before and after issuance of the PAPA ROD (BLM, 2000b) are not available for wellfield roads within the PAPA; however, several monitoring studies at various sites and times throughout the PAPA indicate an increase in traffic volume. For example, Ingelfinger (2001) recorded 12 vehicles per day on the Mesa Road during May and June, 1999. Holloran (2005) measured traffic by axle counts: 113 axles per day (57 vehicles per day if all had 2 axles, 38 vehicles per day if all had 3 axles) on the Mesa Road in 2001. The next year (2002), traffic volume on the Mesa Road decreased, as well as in subsequent years compared to predevelopment volumes (i.e., 22 axles per day in 2002). Most likely, after 2001, wellfield traffic (113 axles per day in 2001) was using the newly constructed North Anticline Road instead of the Mesa Road, portions of which have been reclaimed.

Holloran (2005) also recorded traffic volumes on the Jonah North Road from mid-March through mid-May, which indicated that traffic volume on this road has been increasing since 2001: 59 axles per day in 2001, 73 axles per day in 2002, 125 axles per day in 2003, and 257 axles per day in 2004.

The PAWG Transportation Task Group recommended traffic monitoring to the BLM in September, 2005, and the BLM provided funds for a traffic monitoring site within the PAPA. A radar sensor was installed to collect traffic volume data, although data is not yet available. In August and September 2005 WDOT installed multiple pneumatic traffic counters throughout the PAPA and Jonah Field Project Area. An estimated average of 1,763 vehicles were traveling the combined field road network on each of 2 days sampled, with estimates of 1,141 passenger vehicles, 226 single-unit trucks, 328 single trailer trucks, and 68 multi-trailer trucks.

Winter 2005-2006 was the first time traffic volume was monitored during winter drilling and well production within the PAPA. Traffic information was gathered from November 15, 2005 through April 30, 2006 at an access station (BLM, 2005b) located 400 feet south of the Pinedale/Gobblers Knob Compressor Station (SW¼ NW¼ Section 2, T. 31 N., R. 109 W.), at the main entry point to well field facilities on the Mesa. As each vehicle passed the station, the attendant identified it by specific type: light vehicles including cars, pickup trucks, SUVs and vans, while heavy vehicles were buses, tankers, dump trucks, semi-tractor trailers, among other types. Monthly average traffic volume per day, beginning November 15, 2005 and ending April 30, 2006, is summarized in Table 3.6-3.

Table 3.6-3
Average Number of Vehicle Types Per Day
Passing the ASU Access Station During Winter 2005-2006

Vehicle Type	November	December	January	February	March	April	Period Average
Light Vehicles	206.8	191.0	149.0	191.0	156.7	165.3	173.4
Heavy Vehicles	136.4	96.2	79.0	96.2	69.8	72.9	87.4
Total Vehicles	**343.2**	**287.2**	**228.0**	**287.2**	**226.5**	**238.2**	**260.8**

Questar funded a traffic study, beginning in mid-January and lasting through March 2006. Forty-four traffic counters were placed on roads on the Mesa, including resource roads to individual well pads, local roads to several well pads, and collector roads, including several locations along the North Anticline Road. Some counters were placed on local and resource roads leading to well pads with liquids gathering systems, while other counters were on roads to well pads without liquids gathering pipelines. Counters also documented traffic volume to pads where there was winter drilling by several operators. All traffic data was reported as the median number of vehicles (hits) counted per day during the functional period of each counter (Western EcoSystems Technology, 2006).

Traffic counters placed on the North Anticline Road at various distances from the junction with the Paradise Road show diminishing traffic volumes with increasing distance from the junction (Table 3.6-4). Counters farther from the junction recorded traffic to fewer well pads (assuming all traffic to those destination pads accessed the Mesa from Paradise Road). Traffic related to winter drilling is evident by comparing vehicle round trips (Table 3.6-4) from the counter at 6.93 miles from Paradise Road (21 daily round trips to access 25 well pads) to data from the closer counter, 5.54 miles from the junction (60 daily round trips to access 37 well pads).

Traffic volumes associated with winter drilling and the influence of liquid gathering pipelines on daily traffic are evident from traffic counters placed on local roads and, especially, on resource roads (Table 3.6-5). Average daily traffic to well pads with liquid gathering pipelines is half the traffic to pads without.

Table 3.6-4
Traffic Counter Locations, Traffic Volumes, and Wellfield Components Accessed Beyond Each Counter on the North Anticline Road from mid-January through March, 2006

Distance (miles) of Counter to Paradise Road	Median Vehicle Round Trips per Day [1]	Pads Accessed [2]	Producing Wells Accessed [3]	Pads with Liquid Gathering Pipelines [4]	Wells with Liquid Gathering Pipelines [4]	Pads with Winter Drilling [5]	Maximum Wells Drilled in Winter [6]
0.62 [7]	253	106	228	53	125	7	60
1.87 [8]	175	82	185	53	125	6	54
5.54 [8]	60	37	82	36	79	2	10
6.93 [8]	21	25	52	24	51	0	0

[1] Round trips assumed to be half of the vehicles counted by traffic counters or the actual vehicle count at the access station.
[2] Total number of well pads digitized in 2005 that were beyond each counter's location, assuming all vehicle access was from south to north.
[3] Total number of producing wells from WOGCC (2006).
[4] Questar (Wexpro) pads and wells were assumed to have liquid gathering lines; other Operators were not.
[5] Winter drilling by Questar, Anschutz, Shell and Ultra.
[6] Maximum wells drilled based on all APDs on winter-drilled pads reported by WOGCC.
[7] Data reported by the access station for mid-January through March, 2006.
[8] Western EcoSystems Technology, 2006.

Table 3.6-5
Comparisons of Vehicle Traffic to Well Pads With and Without Liquid Gathering Systems and the Effects of Winter Drilling on Traffic Volume

Resource Road to Well Pad	Sample Size	Averaged Median Vehicle Round Trips per Day	Average Producing Wells Accessed	Vehicles per Day per Producing Well
Without Liquid Gathering System	3	2.67	1.67	1.60
With Liquid Gathering System	8	1.31	2.00	0.66
With Liquid Gathering System and Winter Drilling	2	66.25	4	16.56
Source: Western EcoSystems Technology, 2006.				

3.6.1.2 Vehicular Accidents

The total number of traffic accidents and people injured or killed in Sublette County has increased annually from 2000 through 2005 (Table 3.6-6). In 2000, there were 271 total accidents, three fatalities, and 90 persons injured, compared to a total of 340 accidents, eight fatalities, and 106 persons injured in 2005. Table 3.6-6 summarizes the data collected from 2000 through 2005 for traffic accidents on roads adjacent to the PAPA.

Table 3.6-6
Number of Traffic Accidents on Roads Adjacent to the PAPA

Year	Persons Injured	Persons Killed	Property Damage Only	Injury Accidents	Fatal Accidents	Total Accidents
2000	90	3	207	62	2	271
2001	87	6	201	60	5	266
2002	91	3	222	58	2	282
2003	100	8	217	70	8	295
2004	95	5	233	67	5	305
2005	106	8	259	74	7	340
Source: Carpenter, 2006a.						

From Interstate 80 to Daniel Junction, there were 449 accidents reported by the WDOT from 2001 through 2005 on U.S. Highway 189. Accident frequency along this section of road has remained fairly constant over the 4 years. There were increased vehicular accidents on other major routes to the PAPA during that same time. On U.S. Highway 191 between Rock Springs and Daniel Junction, accidents increased 150 percent from 142 in 2001 to 215 in 2005. A 100 percent increase in accidents was recorded along State Highway 351, connecting U.S. Highway 189 and U.S. Highway 191, where nine accidents were reported in 2001 and 18 accidents were reported in 2005.

WDOT (Carpenter, 2006a) has recorded multiple wildlife-vehicle collisions. Since 1999, most vehicular collisions have been with mule deer though some pronghorn and fewer moose and elk have been killed on area highways including U.S. Highway 191, U.S. Highway 189, and State Highway 351 (see Wildlife and Aquatic Resources, Section 3.22).

3.6.1.3 Maintenance

Increased traffic volume on roads within and adjacent to the PAPA has resulted in a greater need for road repairs and upgrades, including additional lanes and widening of roads and shoulders. As a result, maintenance expenditures have increased since 2000. WDOT is responsible for maintaining U.S. Highways 191 and 189 and State Highway 351, all of which are used to access the PAPA. Although maintenance requirements on these highways have increased (Table 3.6-7), WDOT's funding levels have remained constant over the past 5 years. Sublette County maintains the various county roads servicing the PAPA. The Operators are responsible for preventive and corrective maintenance of all BLM roads within the PAPA.

Table 3.6-7
Highway Maintenance
Expenditures (dollars) from 2000 through 2005

Year	U.S. Highway 191	U.S. Highway 189	State Highway 351
2000	15,564	18,000	17,500
2001	21,500	23,000	28,500
2002	20,400	36,700	34,400
2003	19,200	25,000	54,700
2004	27,900 [1]	21,200	204,300 [1]
2005	156,300 [1]	28,100	65,800

[1] Includes chip sealing projects but not asphalt patching and snow plowing.
Source: WDOT, 2005.

3.6.2 Pipeline Corridors and Gas Sales Pipelines

A regional network of federal, state, county, and local and rural roads provides the basic transportation infrastructure for access to the proposed corridor/pipeline alignments. Many of the local/rural roads have been improved and are maintained by oil and gas operators. North-south trending U.S. Highways 189 and 191 provide principal access to the northern half of the proposed pipeline route (see Map 2.4-1 in Chapter 2). In addition to federal and state highways, access to the corridor/pipeline alignments and New Fork River crossing north of State Highway 351 would be via the Paradise Road and South Boulder Road that parallel the New Fork River on the north and south sides, respectively.

The proposed BCC, R6 pipeline, and PBC pipeline alignments cross the east-west aligned State Highway 351. Access to the proposed corridor/pipeline alignments south of State Highway 351 would be via numerous BLM and local/rural roads, including BLM Road 5406, Burma Road, BLM Road 5410, Sublette County Road 139, Reardon Draw Road, County Line Road bordering

Sweetwater and Sublette County, Sweetwater County Road 8, the Farson Cutoff Road, Sweetwater County Road 52, and BLM Road 4202.

The BFGC and Segment 2 of the R6 Pipeline alignments south of the Green River would be accessed via State Highway 372, U.S. Highway 30 and BLM, county, and local/rural roads. Access to the proposed corridor/pipeline alignments between the Granger Gas Processing Plant and the Blacks Fork Processing Plant would be via State Highway 375, Sweetwater County Road 16 (Granger Road), Old Little America Road, Uinta County Road 233 (Granger Road), and other local/rural roads. Access routes from the proposed OPC and Opal Loop III Pipeline alignment south of the Green River to the Pioneer and Opal gas processing plants would be via U.S. Highway 30, State Highway 240, and BLM Road 4209.

Some existing roads parallel or are adjacent to portions of the proposed corridor/pipeline alignments; but that is not the case for most of the alignments. The local/rural roads are principally graveled or surfaced with native material and typically support low traffic volumes, with the exception of the roads used to access areas of oil and gas development. These rural areas and the roads accessing these areas are more remote than access from more frequently traveled routes, which may impede rapid emergency detection and response (Goehring and Sundeen, 1999).

3.7 LAND USE AND RESIDENTIAL AREAS

3.7.1 Development Within the PAPA

3.7.1.1 Land Use/Land Cover

Present land use and land cover in the PAPA was categorized using the USGS classification system (Anderson et al., 1976), the same system that was used in the PAPA DEIS (BLM, 1999a). In the USGS classification system, there are 13 categories of land use within the PAPA (Map 3.7-1). Table 3.7-1 provides the total surface area of each land use/land cover type defined within the PAPA and included in the PAPA DEIS.

Shrub and Brush Rangeland and Mixed Rangeland are the predominant land use/land cover types within the PAPA, with a combined total of over 178,200 acres. The Cropland and Pasture type is mostly on bottomlands of the Green and New Fork rivers. Likewise, most Nonforested Wetlands are associated with riparian areas or are otherwise proximate to one river or the other and are mostly on private land.

Existing surface disturbance associated with natural gas development in the PAPA is shown in Table 3.7-1. In the USGS classification system, land uses associated with these wellfield components would convert an otherwise undisturbed land use category in Table 3.7-1 to be either Transportation, Communications, Utilities (roads, and pipelines) or Industrial (well pads and other wellfield ancillary facilities). Natural gas related surface disturbance has changed land use/land cover types in the PAPA in approximate proportion to their pre-1999 extent (Table 3.7-1). Most wellfield development in the PAPA has been in the Shrub and Brush Rangeland land use type. Most of the disturbance proposed by Operators for 2006 is in the Shrub and Brush Rangeland land use type.

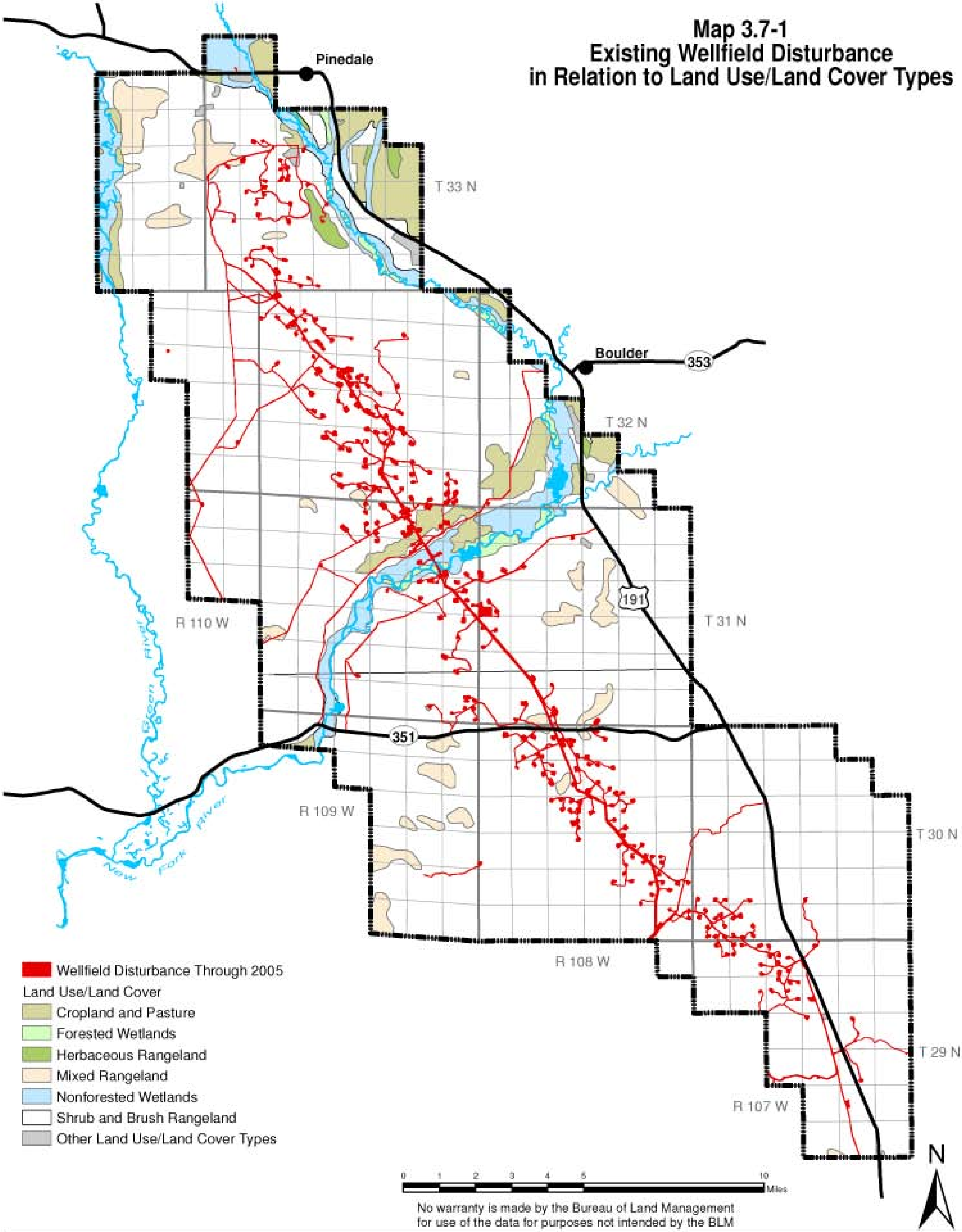

Map 3.7-1
Existing Wellfield Disturbance
in Relation to Land Use/Land Cover Types
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Land Use/Land Cover
Cropland and Pasture
Forested Wetlands
Herbaceous Rangeland
Mixed Rangeland
Nonforested Wetlands
Shrub and Brush Rangeland
Other Land Use/Land Cover Types
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Table 3.7-1
Estimated Existing Wellfield Disturbance in Relation to Land Use/Land Cover Types in the PAPA

Land Use/Land Cover Type	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Cropland and Pasture	7,595	122.2	20.0	142.2	1.9
Forested Wetlands	1,542.32	16.6	8.6	25.2	1.6
Herbaceous Rangeland	855	13.9	0.0	13.9	1.6
Industrial	70	9.5	0.5	10.0	14.3
Mixed Rangeland	6,278	71.2	9.9	81.1	1.3
Nonforested Wetlands	8,964	102.5	9.1	111.6	1.2
Reservoirs	23	0.00	0.0	0.0	0.0
Residential	180	3.5	0.0	3.5	1.9
Sandy Areas Other than Beaches	97	6.1	0.0	6.1	6.3
Shrub and Brush Rangeland	172,005	4,328.6	332.8	4,661.4	2.7
Mines, Quarries and Gravel Pits	167	0.6	0.0	0.6	0.4
Transitional Areas	32	0.6	0.0	0.6	1.9
Transportation, Communication, Utilities	226	3.2	0.0	3.2	1.4
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

3.7.1.2 Sublette County Comprehensive Plan and Zoning

Wyoming State Statutes (Title 9-8-301 and Title 18-5-202) provide for the development of county-level comprehensive plans. The statutes also encourage county planning coordination with federal land and resource management agencies. These locally developed, adopted, and implemented county plans apply to the unincorporated areas within the county and may address public health, safety, moral, and general welfare issues.

The Sublette County Comprehensive Plan was completed in 2003, revising the 1978 plan. The new plan solidifies contemporary versions of the county's vision, goals, and formal land use policies but allows for future revisions and amendments. The purpose of the County Plan is to provide a consistent and clear direction for future land use decisions and development guidelines for officials and policy makers to craft "socially, economically and ecologically sound" decisions (Sublette County, 2003). The County Plan is summarized by the following key points:

- The County's unique culture - characterized by a rural, "Wyoming" essence - shall be preserved and enriched through a thriving private business sector, a healthy working family-based environment, and friendly, crime-free communities.
- Economic freedom shall pervade and provide diverse opportunities through reasonable taxation, low cost of living, limited regulation, and wise development of natural resources.
- The natural environment shall reflect the high value residents place on clean air and water, wide open and rural landscapes, and a healthy, diverse base of natural resources including water, land, minerals, oil, gas, plants, and animals.
- The county shall remain free of excessive land use regulation and protect private property rights.

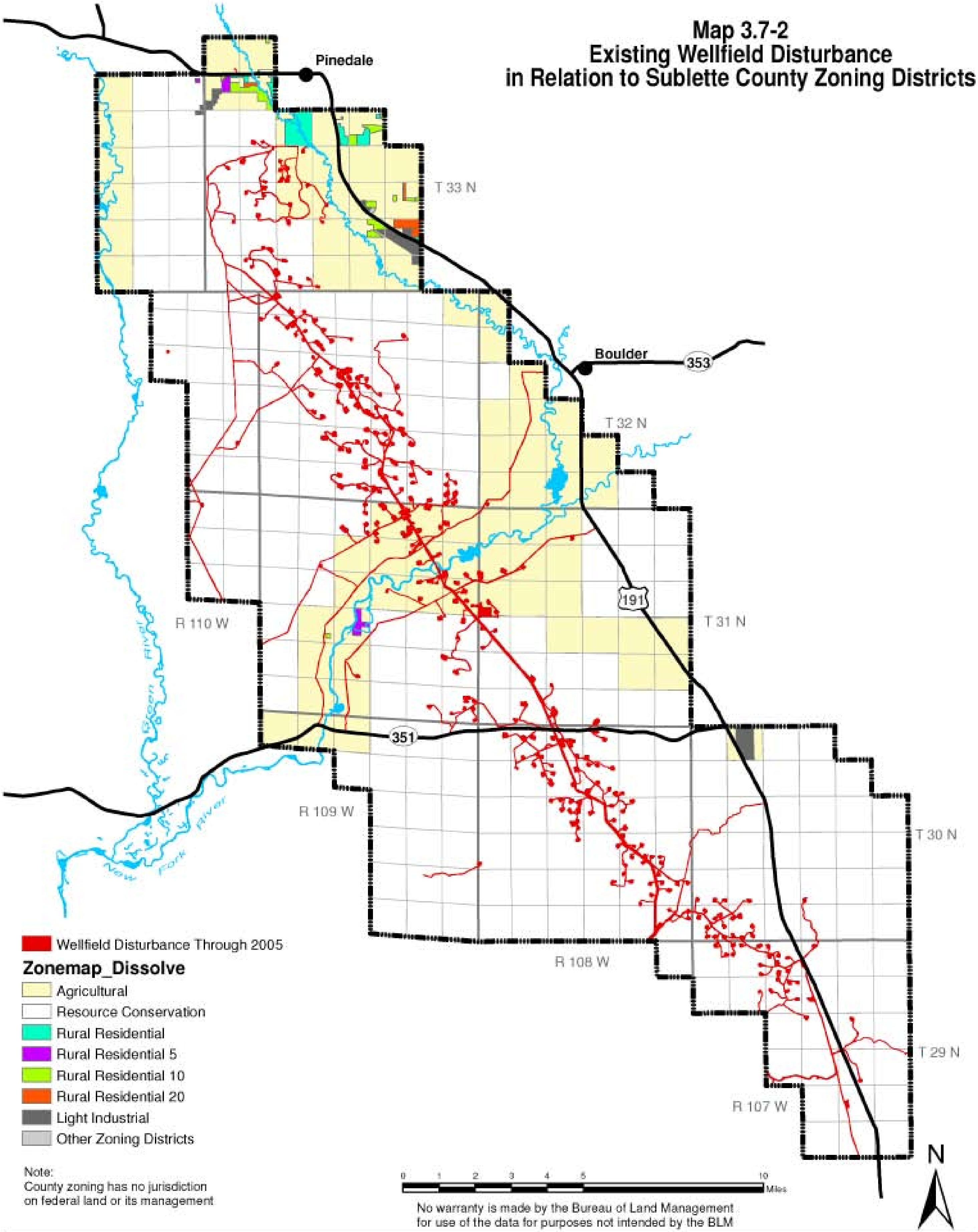
The Sublette County Zoning and Development Regulations (Sublette County, 2002) were most recently revised in 2003. The regulations aid in implementing the Sublette County Comprehensive Plan, provide for orderly and well-planned development within the County, protect the various land uses and zones from harmful encroachment by incompatible uses, and ensure that land allocated to a zoning district is not usurped by other, inappropriate, uses. Detailed descriptions of the PAPA's 11 zoning districts (Map 3.7-2) are provided in the PAPA DEIS (BLM, 1999a) and the Sublette County Zoning and Development Regulations.

Table 3.7-2 provides the total surface area and existing wellfield disturbance within the PAPA in each zoning district. Most wellfield development is in the Resource Conservation Zoning District which protects and conserves environmentally sensitive areas where development is limited (Sublette County, 2002). As of December 2005, over 4,000 acres had been disturbed in that zoning district, which is nearly 93 percent of all wellfield development in the PAPA (Table 3.7-2). Most wellfield disturbance projected for 2006 is in the Resource Conservation Zoning District (Table 3.7-2). Most of the area designated as Resource Conservation zoning within the PAPA is on federal lands and minerals ownership.

While Sublette County has included federally administered lands within their zoning districts, normally the county has no jurisdiction on those lands. The Sublette County Comprehensive Plan advocates that land use plans developed by the BLM and other federal agencies be coordinated and consistent with the Sublette County Comprehensive Plan and the Sublette County Conservation District Natural Resource Statement.

Table 3.7-2
Wellfield Disturbance in Relation to Sublette County Zoning Districts

Sublette County Zoning District	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Agricultural	46,527	1,026.5	93.2	1,119.7	2.4
Highway commercial	33	0.5	0.0	0.5	1.5
Heavy industrial	37	0.0	0.0	0.0	0.0
Light Industrial	458	6.6	0.0	6.6	1.4
Rural residential	1,398	11.9	0.0	11.9	0.9
Rural residential 10	366	5.6	0.0	5.6	1.5
Rural residential 20	167	0.8	0.0	0.8	0.5
Rural residential 5	128	2.2	0.0	2.2	1.7
Rural residential mobile/manufactured home 10	34	0.0	0.0	0.0	0.0
Resource Conservation	148,870	3,624.4	287.7	3,912.1	2.6
Rural mixed	16	0.0	0.0	0.0	0.0
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**


Map 3.7-2
Existing Wellfield Disturbance
in Relation to Sublette County Zoning Districts
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Zonemap_Dissolve
Agricultural
Resource Conservation
Rural Residential
Rural Residential 5
Rural Residential 10
Rural Residential 20
Light Industrial
Other Zoning Districts
Note:
County zoning has no jurisdiction
on federal land or its management
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

3.7.1.3 Residential Areas and Subdivisions

Most land in the PAPA that is zoned by the County for residential use is concentrated in the north. These areas represent an estimated 2,093 acres of the PAPA and are primarily within or adjacent to Pinedale and Boulder. According to Sublette County Planning and Zoning data, there are 43 subdivisions in or overlapping the PAPA, with eight subdivisions added since issuance of the PAPA ROD (BLM, 2000b).

The PAPA DEIS (BLM, 1999a) established the Residential SRMZ that was defined to be within 0.25 mile of existing residences and areas zoned primarily for residential use around portions of the PAPA (Map 3.7-3). The SRMZ does not include residences constructed after July 2000. Approximately 138 acres within the Residential SRMZ (as defined in July 2000) have been disturbed by wellfield development through December 2005. Another 7 acres is projected to be disturbed in 2006.

3.7.2 Pipeline Corridors and Gas Sales Pipeline

The proposed corridor/pipeline alignments traverse rural, nonurban areas in Sublette, Sweetwater, Lincoln, and Uinta counties. All four counties are primarily rural and tied to traditional natural resource-based industries. Agricultural and mineral extraction industries, particularly oil and gas, are principal land uses. The proposed corridor/pipeline alignments through Sublette County are primarily within the Resource Conservation Zoning District. Areas in Sweetwater County crossed by the proposed corridor/pipeline alignments are zoned agricultural with some areas of minerals development. Areas in Lincoln County crossed by the proposed corridor/pipeline alignments are zoned rural. The proposed pipeline alignment in Uinta County parallels existing pipeline rights-of-way in the immediate vicinity of the Blacks Fork Plant.

3.8 RECREATION RESOURCES

3.8.1 Development Within the PAPA

3.8.1.1 Recreational Activities

A brochure promoting Sublette County recreation opportunities claims the county is “Better than Yellowstone! Breathtaking, Wild, Uncrowded” (Sublette County Joint Tourism Promotion Board, 2006). Sublette County’s location as a gateway community for travelers en route to Yellowstone and Grand Teton National Parks is important, though the County has amenities that make it an attractive final destination. The BLM Recreation Management Information System (RMIS) for the Pinedale Field Office Administrative Area (12.9 percent of BLM managed lands in southwestern Wyoming) estimated that there were 319,978 total recreation days (one day spent by one person recreating) per year, averaged from 1998 through 2002 and distributed among 23 recreational activities (Table 3.8-1). According to the RMIS data, the most prevalent recreation uses in the PAPA and vicinity are boating and fishing on the New Fork and Green rivers.

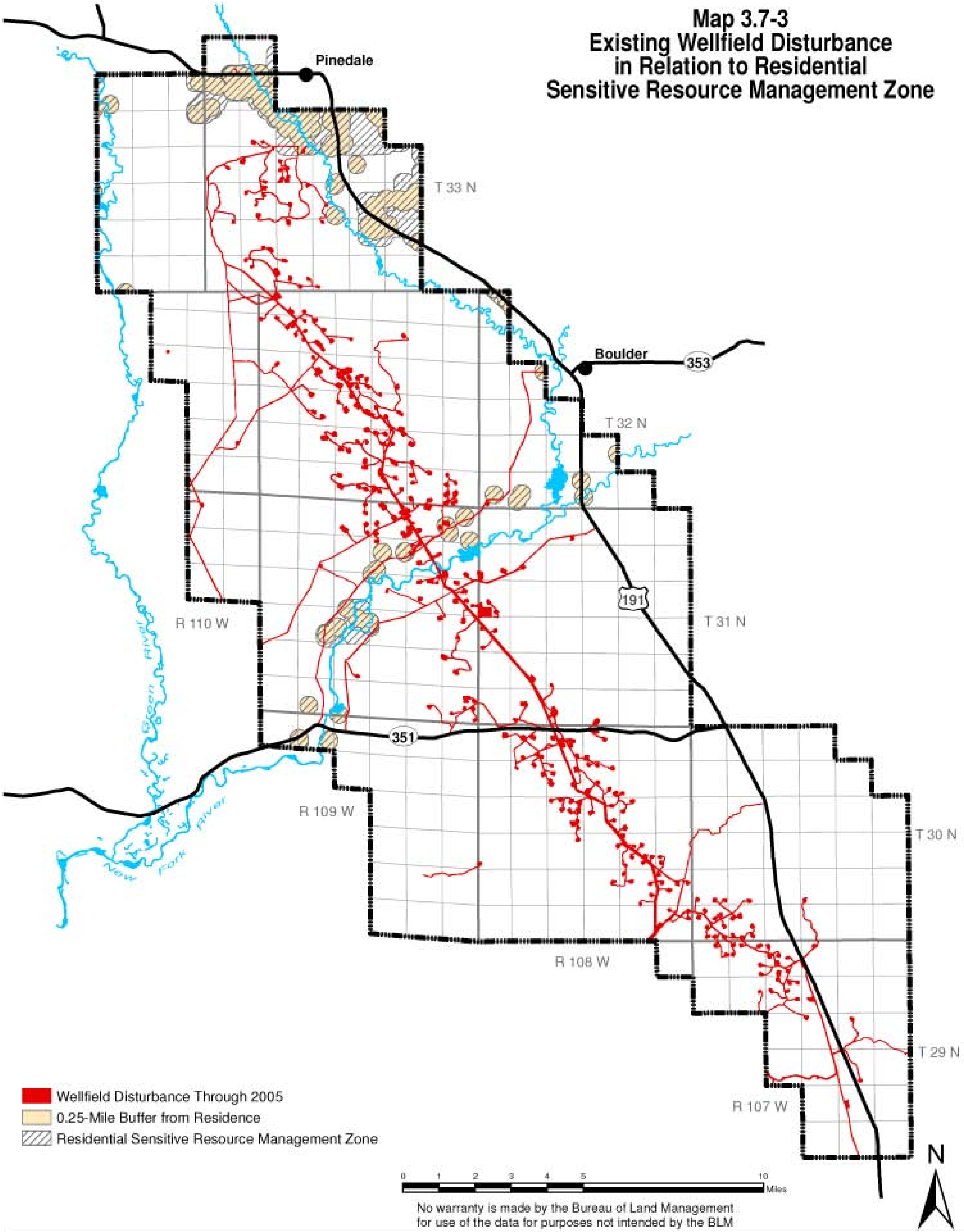

Map 3.7-3
Existing Wellfield Disturbance
in Relation to Residential
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
0.25-Mile Buffer from Residence
Residential Sensitive Resource Management Zone
0
1
2
3
4
5
10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

Table 3.8-1
Recreation Use Days in the BLM Pinedale Field Office Administrative Area October 1998 through September 2002

Recreational Activity	Recreation Days Per Year
Row/float/raft-boating	138,630
Fishing	73,227
Camping	35,168
Nonmotorized travel (hiking, walking, running)	30,581
Snowmobiling	12,368
Pack trips and backpacking	6,864
Mountain biking	5,066
Driving for pleasure	4,182
Viewing wildlife	2,727
Cross country skiing	2,123
Picnicking	1,366
Off-highway vehicles (all-terrain vehicles)	1,268
Nature study	880
Photography	880
Swimming	854
Staging/comfort stop	829
Motorized boating	789
Archery	760
Horseback riding	732
Rock climbing	458
Off-highway vehicles (cars/trucks/SUVs)	155
Environmental education	55
Road bicycling	16
TOTAL	**319,978**
Source: BLM, 2003a	

Big game hunting (pronghorn antelope, elk, moose, and mule deer) is another major recreational activity in the PAPA. Hunting recreation-days is not included in the RMIS data set. WGFD manages harvest of big game by Hunt Areas, several of which may cover big game populations' herd units. WGFD has collected hunter and harvest data needed to compute recreation-days in each of the big game Hunt Areas that coincide with or are in the immediate vicinity of the PAPA (Table 3.8-2). In 2001, for example, there were 28,977 recreation-days of hunting in those Hunt Areas.

Various game bird species, including ducks, geese, mourning doves, and greater sage-grouse, are also hunted within the PAPA and vicinity. Wildlife viewing (e.g., mule deer on winter range) on the Mesa is another local recreational activity because it is relatively accessible from Pinedale.

Table 3.8-2
Resident and Non-Resident Recreation-Days of
Hunting Big Game in the Vicinity of the PAPA from 2000 to 2005

Hunter Category	2000	2001	2002	2003	2004	2005[1]
Antelope Hunt Areas 87 and 90:						
Residents	1,776	1,454	1,760	1,771	1,784	1,366
Non-Residents	795	681	649	545	830	917
Total	**2,571**	**2,135**	**2,409**	**2,316**	**2,614**	**2,283**
Mule Deer Hunt Areas 138, 139, 140:						
Residents	5,810	7,380	8,819	7,137	4,943	4,683
Non-Residents	908	137	1,498	1,308	852	1,071
Total	**6,718**	**7,517**	**10,317**	**8,445**	**5,795**	**5,754**
Elk Hunt Areas 96, 97, and 98:						
Residents	13,610	14,094	15,019	12,612	11,021	9,981
Non-Residents	2,991	3,801	3,676	1,305	2,886	3,220
Total	**16,601**	**17,895**	**18,695**	**13,917**	**13,907**	**13,201**
Moose Hunt Area 4:						
Residents	253	193	237	293	126	357
Non-Residents	29	7	31	336	33	17
Total	**282**	**200**	**268**	**629**	**159**	**374**
Total Net Economic Value of Hunting, Residents and Non-residents						
	$1,308,389	**$1,410,381**	**$1,575,935**	**$1,330,593**	**$1,090,314**	**$1,608,239**

[1] Estimates from Frost, 2006; Clause, 2006a, 2006b, and 2006c.
Sources: WGFD 2002a, 2003a, 2004a, 2005a and 2006a; BLM, 1988b; and DOI et. al., 2003.

As the human population grows in Sublette County (see Section 3.5, Table 3.5-6), the need for dispersed recreation is expected to increase in the PAPA. The U.S. Fish and Wildlife Service (FWS) collects state-level data on fishing, hunting, and wildlife-viewing every 5 years. The most recent surveys, in 1996 and 2001, were used to estimate the rate of change in recreation demand for Wyoming (Table 3.8-3). Hunting and wildlife viewing decreased while fishing increased.

Table 3.8-3
Recreation-Days Spent Fishing, Hunting,
and Viewing Wildlife in Wyoming During 1996 and 2001

Recreation Activity	1996	2001	Percent Change 1996-2001
Total Days of Fishing	3,827,000	4,398,000	14.9
Total Days of Hunting	2,398,000	2,174,000	-9.3
Total Days of Wildlife Viewing (non-residents only)	669,000	511,000	-23.6

Source: FWS, 1998 and 2003c.

Recreation demand in Sublette County is hypothesized to follow patterns observed for Wyoming. Based on that assumption, Table 3.8-4 provides an estimate of change in recreation days from 2001 to 2006. While recreation days spent fishing are likely to increase, time spent viewing wildlife and hunting is expected to decrease in the County.

Table 3.8-4
Estimated Recreation-Days for Activities in Sublette County During 2001 and 2006

Year	Fishing	Wildlife Viewing	Hunting	Other [1]	Total
2001	73,227	2,727	28,977	244,024	348,955
2006	78,280	2,362	27,557	244,024	352,223[2]

[1] Includes recreation-days spent other than fishing, wildlife viewing, and hunting
[2] Total in 2006 assumes that recreation-days for "Other" activities remained the same as in 2001.
Sources: BLM, 2003a; FWS, 1998 and 2003c.

3.8.1.2 Recreation Sites and Facilities

Adventure Cycling has proposed a route through the PAPA from Pinedale to Boulder which would be part of a 4,000 mile Great Divide Mountain Bike Route (see Map 3.8-1). Currently, BLM has not authorized this route through the PAPA and it has been removed from Adventure Cycling's guide map and brochure. There is a network of bike trails in the PAPA, called the Mesa Mountain Bike Trail; however, BLM has not finalized the maps and brochures for these trails (Hudson, 2006).

There is a large area in the north end of the PAPA, near Mount Airy, which was identified by BLM as a possible Off-Highway Vehicle (OHV) use area prior to 1999. An OHV plan was not developed for the Mount Airy site, and there has been no progress in its designation. The Pinedale RMP (BLM, 1988a) restricted travel on the Mesa during the winter to protect mule deer and antelope on winter ranges. Other travel was limited to existing roads and trails. Seasonal use restrictions could also apply to the Mount Airy OHV Area, if needed. The Pinedale RMP designated the area south of the New Fork River a general OHV open area, and it has been open year-round to OHV use (Map 3.8-1).

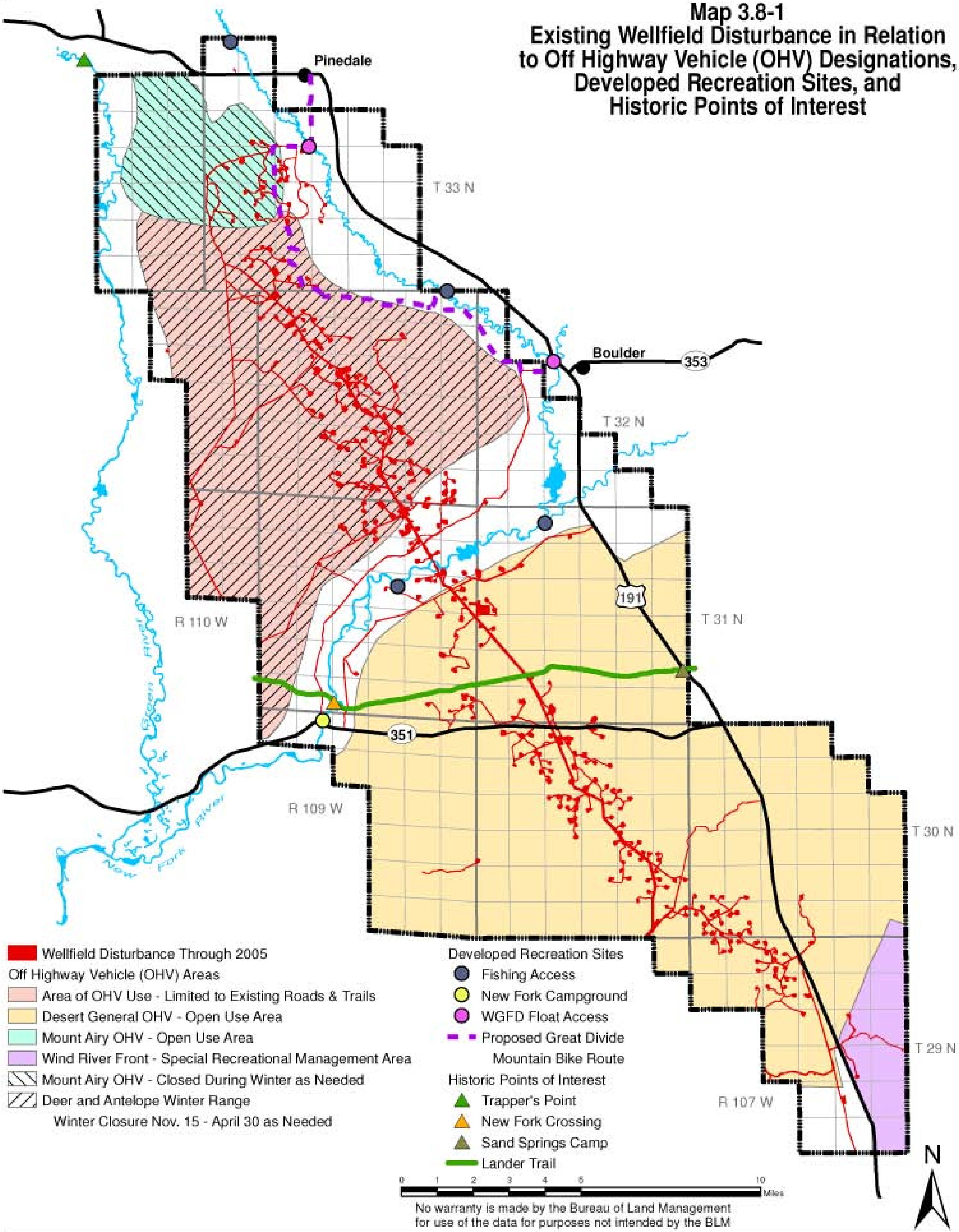
A portion (5,141 acres) of the southeastern part of the PAPA coincides with the Wind River Front Special Recreation Management Area (SRMA) which is managed by BLM's Rock Springs Field Office. The portion of the SRMA in the PAPA has been managed for dispersed recreation (camping, hunting, and fishing), with full consideration given to wildlife, cultural resources, vegetation, watershed values, and mineral development activity, as specified in BLM's 1997 Green River RMP. The entire western portion of this SRMA has been open to mineral leasing.

As of December 2005, there were approximately 27 acres of wellfield disturbance within the Wind River Front SRMA that coincides with the PAPA (Table 3.8-5). Most development has been in the Desert General OHV Open Use Area, south of the New Fork River. By December of 2005, there were over 2,200 acres of wellfield disturbance in the Desert General OHV Open Use Area, with an approximate disturbance of more than 3,900 acres in all public recreation areas. An additional 318.3 acres of wellfield disturbance is projected for 2006 in all public recreation areas (Table 3.8-5).

Table 3.8-5
Estimated Existing Wellfield Disturbance in Relation to Public Recreation and OHV-Designated Areas in the PAPA

Recreation Area	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Mount Airy OHV Area	9,202	178.6	17.2	195.8	2.1
OHV Areas Limited to Existing Roads, Trails	48,036	1,463.1	149.2	1,612.3	3.4
Desert General OHV Open Use Area	9,0361	2,238.9	151.9	2,390.8	2.6
Wind River Front Special Recreation Management Area	5,141	26.6	0.0	26.6	0.5
Total	**152,740**	**3,907.2**	**318.3**	**4,225.5**	**2.8**

Map 3.8-1 Existing Wellfield Disturbance in Relation to Off Highway Vehicle (OHV) Designations, Developed Recreation Sites, and Historic Points of Interest



Both the New Fork and Green rivers flow through the PAPA. The WGFD's Basin Management Plans (WGFD, 2006b) include three stream segments on the New Fork River and one on the Green River that flow through the PAPA. On the New Fork River, from Green River to East Fork River, anglers find brown trout, rainbow trout, and Snake River cutthroat trout. On the East Fork River to Pine Creek, anglers find brown trout and rainbow trout and on the Pine Creek to New Fork Lake, anglers find brown trout and brook trout. Locations for camping, fishing access, and boating access along the New Fork and Green rivers are included in Map 3.8-1.

3.8.2 Pipeline Corridors and Gas Sales Pipeline

BLM and Bureau of Reclamation (BOR) lands that would be crossed by the proposed corridor/pipeline alignments support dispersed recreation including hiking, camping, mountain biking, fishing, river-running, sight-seeing, wildlife viewing, and hang gliding (Sweetwater Joint Travel and Tourism Board, 2006). Specific destinations for recreational experiences near the proposed corridor/pipeline alignments include Fontenelle Reservoir, Seedskadee National Wildlife Refuge, and a network of historic trails.

Fontenelle Reservoir is located on the Green River 24 miles southeast of La Barge, Wyoming. The proposed OPC and Opal Loop III pipeline alignment is approximately 3.3 miles west of the Fontenelle Reservoir at its closest point. Recreation use is low volume and seasonal. Fontenelle Creek Campground has developed campsites with restrooms and running water. The creek enters the reservoir approximately 8 miles west of the OPC and Opal Loop III pipeline alignment. Three other campsites are located approximately 2 miles west of the alignment below the dam and are more primitive. Stream fishing opportunities exist on the Green River upstream and downstream from the reservoir (Sweetwater County Joint Travel and Tourism Board, 2006).

Seedskadee National Wildlife Refuge is located approximately 0.5 mile to the east of the proposed BFGC alignment along the Green River and is used by nonconsumptive recreationists (wildlife viewing). Hunters pursue numerous game species on the refuge, including antelope, mule deer, greater sage-grouse, and waterfowl. The Green River also offers world class trout fishing opportunities for anglers year round (Sweetwater County Joint Travel and Tourism Board, 2002). The network of historic trails in the area provides a unique recreational and historic experience for mountain bikers. The Oregon Trail, California Trail, Pony Express Trail, Mormon National Historic Trail, and the Overland Stage route are all suited to mountain biking (Sweetwater County Joint Travel and Tourism Board, 2002).

Each of the three proposed corridors and pipeline alignments cross the Little Colorado Wild Horse Herd Management Area (HMA), managed by BLM's Rock Springs Field Office. The appropriate management level for this HMA is 100 horses. Spring and early summer are good times to watch wild horses when young foals are present (Sweetwater County Joint Travel and Tourism Board, 2002).

3.9 VISUAL RESOURCES

3.9.1 Development Within the PAPA

BLM manages visual resources in several Visual Resource Management (VRM) classes within the Pinedale Field Office Administrative Area. The PAPA contains three VRM classes; Class II, Class III, and Class IV. The management objectives for each VRM class were described in the PAPA DEIS (BLM, 1999a) and are reiterated, below:

- Class II – The objective of this class is to retain the existing character of the landscape. The level of change to the character of the landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- Class III – The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV – The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of the viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements found in the predominant natural features of the characteristic landscape.

The most extensive natural gas development in the PAPA has been within VRM Class IV, which incorporates approximately 126,510 acres or about 64 percent of the PAPA (see Map 3.9-1). As of December 2005, more than 3,000 acres in VRM Class IV had been disturbed by wellfield activities (Table 3.9-1). The least amount of wellfield disturbance is on lands in the VRM Class II designation which are a minor portion of federally managed lands and minerals in the PAPA. Those areas are located primarily along the river flood plains on private lands. Consistent with the past, most new disturbance projected in 2006 is within VRM Class IV areas (Table 3.9-1).

Table 3.9-1
Estimated Existing Wellfield Disturbance in Relation to Visual Resource Management Classifications in the PAPA

VRM Classes	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
VRM II	22,013	333.0	21.8	354.8	1.6
VRM III	49,511	1,024.5	69.2	1,093.7	2.2
VRM IV	126,510	3,321.0	289.9	3,610.9	2.9
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

The PAPA DEIS (BLM, 1999a) established a Sensitive Viewshed SRMZ to address public concerns regarding the visual sensitivity of the portion of the PAPA that is visible from Pinedale and U.S. Highway 191 leading into town. The Sensitive Viewshed was modeled to include areas visible from the six viewpoints shown on Map 3.9-2. MA 4 incorporates portions of the Sensitive Viewshed SRMZ, the 'face of the Mesa', and VRM classes II and III along the Green and New Fork rivers. The management objective of MA 4 is to retain the existing character of the landscape, where management activities may be seen but should not attract the attention of the casual observer.

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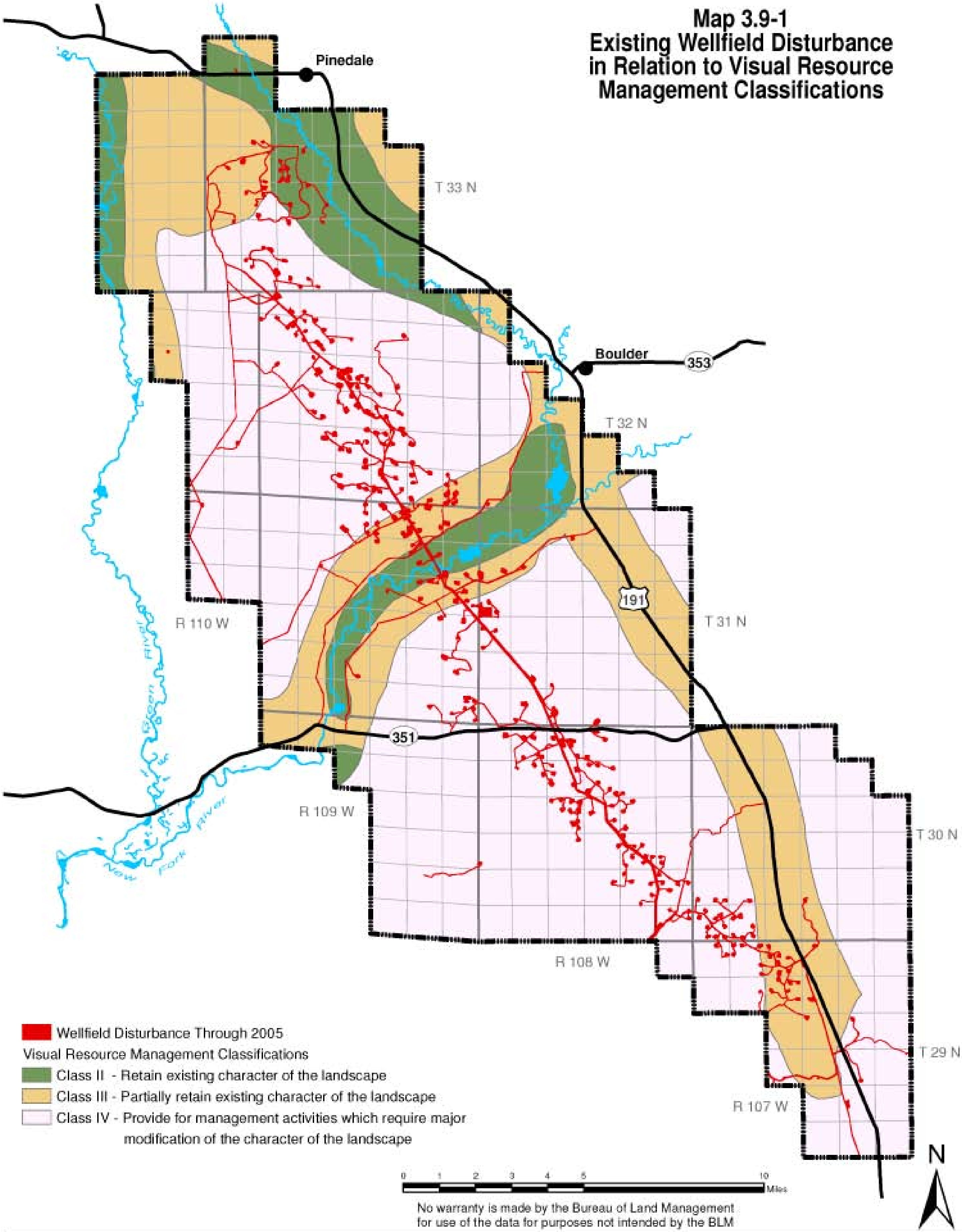
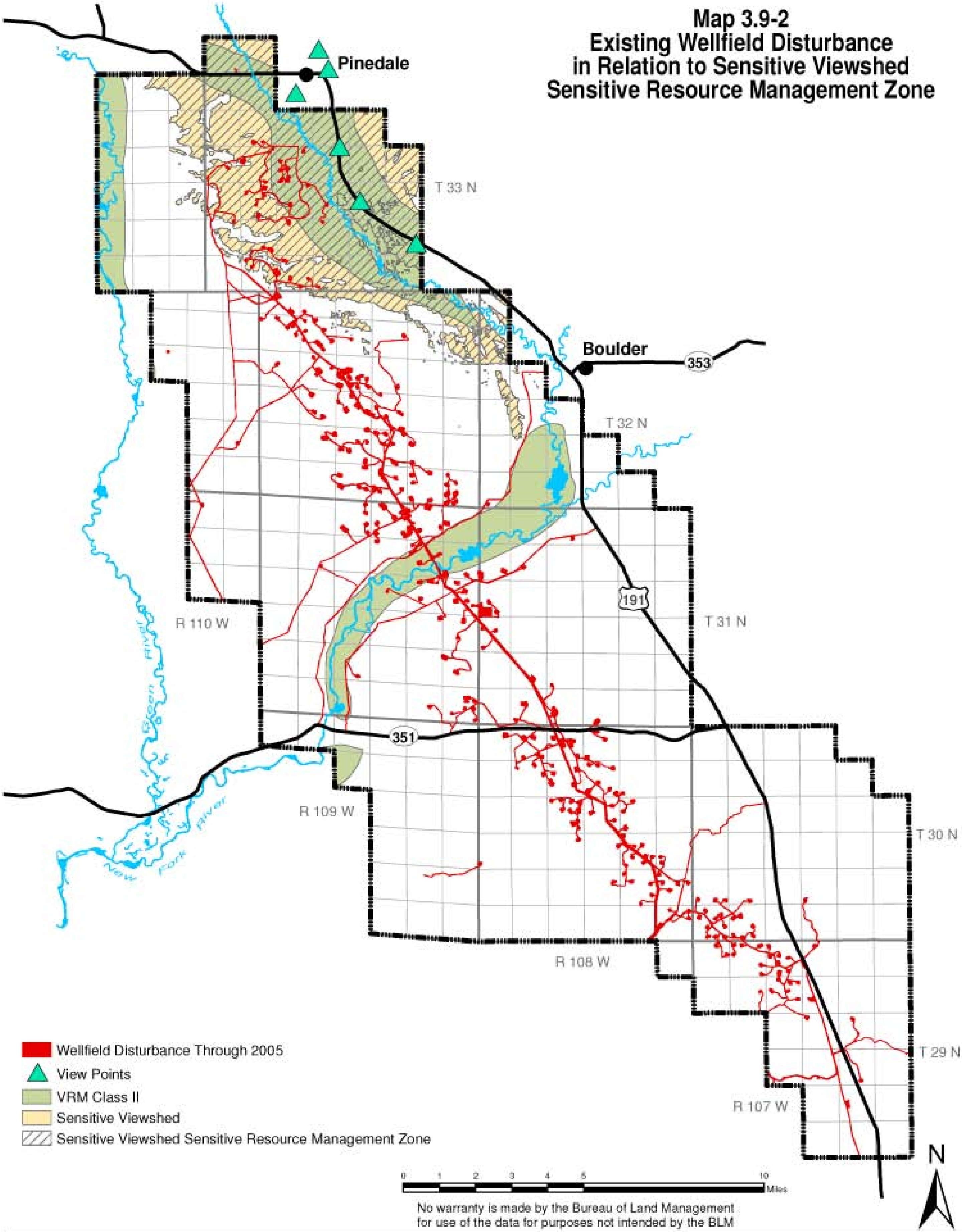

Map 3.9-1
Existing Wellfield Disturbance in Relation to Visual Resource Management Classifications
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Visual Resource Management Classifications
Class II - Retain existing character of the landscape
Class III - Partially retain existing character of the landscape
Class IV - Provide for management activities which require major modification of the character of the landscape
0 1 2 3 4 5 10 Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N

Map 3.9-2
Existing Wellfield Disturbance in Relation to Sensitive Viewshed Sensitive Resource Management Zone



The major portion of the Sensitive Viewshed SRMZ is classified as VRM Class II and VRM Class III and is located in the northern portion of the PAPA (Map 3.9-2). The Sensitive Viewshed SRMZ covers 21,526 acres in the PAPA. As of December 2005, there were approximately 390.4 acres of wellfield disturbance in the Sensitive Viewshed SRMZ. The Operators have proposed an additional disturbance of 15.8 acres in that area in 2006. In all, 406.2 acres of the Sensitive Viewshed SRMZ (1.9 percent of the total viewshed area) will have been disturbed at the end of 2006.

3.9.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments cross three VRM sensitivity classes (classes II, III, and IV) and are adjacent to existing rights-of-ways for pipelines, roads, or other linear features for most of the proposed lengths.

VRM Class II areas that would be crossed by the proposed corridor/pipeline alignments are associated with the New Fork and Green rivers, their valleys/flood plains, and adjacent uplands on either side of the rivers. VRM Class III areas that would be crossed are adjacent to the Class II area along the Green River and north and south of the New Fork River. VRM Class IV areas occupy the remainder of lands crossed by the proposed corridor/pipeline alignments.

3.10 CULTURAL AND HISTORIC RESOURCES

3.10.1 Development Within the PAPA

The BLM manages cultural resources on public lands in accordance with the Antiquities Act of 1906, National Historic Preservation Act of 1966, Native American Graves Protection and Repatriation Act, the Archaeological Resources Protection Act of 1979, and various other codes and Executive Orders. The management process is governed by the requirements of the State Protocol Agreement, recently revised in 2006, between the BLM and the Wyoming State Historic Preservation Office (SHPO) (see Appendix G). Specifically, BLM management in the PAPA focuses on identifying and protecting cultural and historical sites, as well as resolving conflicts between cultural/historic resources and other resource uses (BLM, 1988b and 1999a). An overview of cultural and historic resources and site types found in the PAPA were described in the PAPA DEIS (BLM, 1999a) and the Cultural Technical Report, appended to the PAPA DEIS.

Sites are categorized according to type of cultural resources identified in a particular survey area. Within the PAPA, site types include (but are not limited to) prehistoric campsites, house pits, human burial sites, lithic procurement sites, rock alignment sites (tipi rings, medicine wheels, and cairns), the Lander Trail (which is part of the National Historic Trail system), pioneer settlements, early Euroamerican homesteading remains, stock maintenance sites, and townsites (BLM, 1999a). Sites are also described as prehistoric archaeological sites and landscapes, ethno-historic sites and landscapes, historic sites and landscapes, and historic trails (BLM, 2003b).

The Trappers Point area north of the PAPA is known for its rich archeological sites. Terraces of the New Fork River and the Blue Rim Area carry significant potential. Rock alignment sites are concentrated around the edges of the Mesa (Crume, 2006). Trappers Point is a crucial stock sorting area for “The Drift”, a century-old seasonal stock driveway considered part of a potential Sublette County Rural Ranching Traditional Cultural Property and potentially, a Rural Historic Landscape. Other historical resources in the PAPA include pioneer settlements such as the New Fork Townsite, listed on the National Register of Historic Places (NRHP), the James Bertram Homestead, and the C. B. Faler Ranch. These sites are located on the perimeter of the PAPA, away from the Anticline Crest where most of the gas development has occurred.

Within the PAPA and intersecting the Anticline Crest are historic pioneer trails and travel routes including the New Fork Wagon Road, Lander Cut-off of the Oregon Trail (Lander Trail), and a wagon road from Big Piney to New Fork (BLM, 1999a).

Other historic sites in the PAPA and vicinity are associated with the early fur trade, the frontier military, railroads, the mining industry, ranching, and early oil and gas development (BLM, 1997). However, approximately 75 percent of the sites found in the Green River Basin are prehistoric. Prehistoric cultural materials found at these sites include stone tools, projectile points, metates (grinding slabs), and ceramics. Archeological features frequently found include individual fire hearths, hearth clusters, and an abundance of Archaic Period (8,000 to 2,000 years ago) house pits (BLM 1997, and Vlcek, 2006). The New Fork House pit site contains several 6,000-year old house structures with what has been preliminarily interpreted as a structure utilized for smoking meat. That site was discovered during construction of the gas sales pipeline authorized by the PAPA ROD (BLM, 2000b).

In the PAPA DEIS (BLM, 1999a), several archeological sites eligible for NRHP were documented along the Anticline Crest and later subjected to pipeline construction. Those sites have been the subject of several mitigative excavations. Since the issuance of the PAPA ROD (BLM, 2000b), numerous significant sites (those eligible for inclusion in the NRHP) have been identified. During excavation of a well pad near the northern end of the Pinedale Mesa, a site was discovered yielding a particularly dense concentration of prehistoric features. Salvage excavations during well pad construction recovered over 70 hearths, hearth remains, and other buried archeological materials within a 5 acre study plot. In the same vicinity during 2006, expansion of a well pad yielded archeological discoveries as well as a unique rock alignment that required a specific management strategy.

During 2006, a Folsom projectile point estimated to be 11,500 years old was discovered at a proposed well pad site in the southern end of the PAPA. Folsom sites are among the oldest prehistoric occupations known in North America. Construction of the proposed pad was cancelled. Wellfield development has been proposed near a natural feature considered sensitive to modern Native Americans on the southern end of the PAPA. That proposal has required ongoing Native American consultations.

3.10.1.1 Native American Concerns

Several recognized Native American Tribal groups, including the Shoshone, Bannock, Ute, Crow, Arapahoe and Blackfoot, as well as prehistoric peoples, frequently used the lands within and surrounding the PAPA (BLM, 1999a). BLM has identified several dozen sacred sites, sites important or considered sensitive to modern day Native Americans, as well as formally recognized Traditional Cultural Properties within the PAPA. There is a high potential for the discovery of sacred sites and sites of interest to modern Native Americans. Sites most likely to be discovered will probably be related to prehistoric and historic Native American hunting and seasonal activities. These will likely be rock alignments, burials, traditional use areas, and areas or locales that are identified during Native American consultation.

BLM engages in ongoing proactive consultation with affected Native Americans, in particular the Shoshone, concerning the identification and management of cultural resources (BLM, 1999a and 2003a). In 2004, consultation with the Shoshone Tribe resulted in a set of tribal guidelines for buffer zones for development near Native American sites. These guidelines, dictated from tribal elder Richard Ferris, Sr., are frequently used by BLM but stand as non-binding recommendations:

For seismic activity:

simple cairns that are stable and embedded in the soil: 300 feet is sufficient to protect these sites;

standing cairns: distance for protection will be decided upon on a case-by-case basis;

medicine wheels: case-by-case basis, 0.25 mile should be considered standard;

rock art: 0.25 mile minimum;

human burials and burial areas: 1 mile minimum, no exceptions;

fire pots: 300 feet;

receiver lines – rock art: 300 feet avoidance; and

receiver lines – complex cairns: can be laid carefully through sites, monitoring may be needed; no OHV use is permitted – foot traffic only.

For construction (well pads, roads, pipelines, etc.):

simple cairns that are stable and embedded in the soil: 0.25 mile;

standing cairns: 0.25 mile;

medicine wheels: 0.25 mile;

rock art: 0.25 mile;

human burials and burial areas: 1 mile minimum, no exceptions: and fire pots: 0.25 mile.

For powerlines:

simple cairns that are stable and embedded in the soil: 300 feet or follow road if possible;

standing cairns: 300 feet or follow road if possible;

medicine wheels: 0.25 mile;

rock art: 0.25 mile;

human burials and burial areas: 1 mile minimum, no exceptions; and

fire pots: 300 feet.

General: All other Tribal interests or sites and projects that are of concern to the Tribal interests can be considered on a case-by-case basis, by consultation. The Shoshone rely upon information provided to them by BLM to determine sensitive sites, practicalities, and general project information. The Tribal recommendation is a visual inspection (on-site examination) for anything considered sensitive, not mentioned in the above guidelines. If the guideline as presented above proves not to be workable, individual consultation will be needed (Ferris, 2004).

Approximately 527 sites (Vlcek, 2006) had been inventoried on over 5,320 acres within the PAPA prior to December 2005, and many additional sites have been inventoried since then. Class III inventories were used during these investigations and are the current BLM standard. A Class III inventory is defined as a cultural resources inventory when 100 percent of the surface within the study area surface is surveyed using pedestrian inventory methods. It is likely that the PAPA contains many more cultural resources than those inventoried to date.

3.10.1.2 Unexpected Discoveries

Unintentional damage occurs at an increasing rate as development projects impact buried sites in sensitive archeological areas (BLM, 2003b). Construction of access roads, well pads, pipelines and other surface disturbances can produce unexpected cultural resource discoveries. During the 5 years since issuance of the PAPA ROD (BLM, 2000b), there have been 38 unexpected discoveries in the PAPA. Well pad and access road construction accounted for 23 discoveries, while pipeline construction resulted in 14. Some of those have been discussed in other parts of this section. Powerline construction resulted in one unexpected find (Crume, 2006).

3.10.1.3 Major Finds

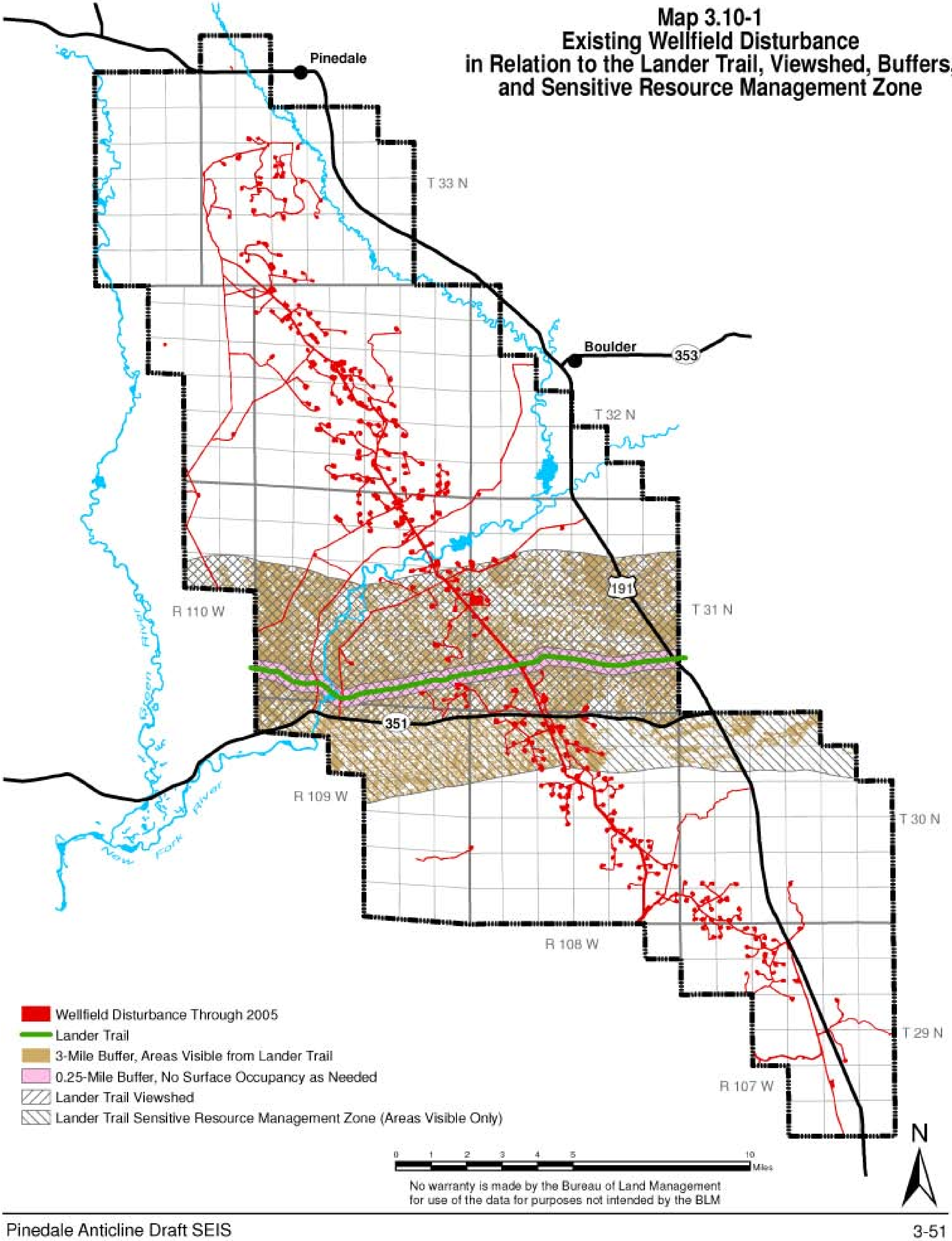
During the first 5 years of wellfield development in the PAPA, one especially sensitive archeological zone was revealed in the sandy bluffs on the north side overlooking the New Fork River. Several discoveries in that sensitive zone were initially impacted by construction of well pads and other wellfield components. Sites found on the sandy bluffs overlooking the New Fork River have yielded abundant large mammal bones, lithic materials, and numerous features (firepits and component staining) indicative of prehistoric hunting and camping patterns. The extensive presence of the faunal materials suggests prehistoric exploitation of large game seasonal migrations in the area. Radio carbon dating of remains has documented use of the sandy bluffs during 5,000 to 7,000 years ago. A similar pattern of seasonal exploitation of large migratory game has been documented at the Trappers Point site (north of the PAPA) where a 6,000-year old antelope kill site has been excavated, a period coinciding with large game exploitation along the New Fork River.

3.10.1.4 Lander Trail SRMZ

The Oregon Trail system, in which the Lander Trail Cut-off is included, is listed on the NRHP. The PAPA ROD (BLM, 2000b) established a 0.25-mile buffer from the Lander Trail within which BLM could prohibit construction activities on federally administered lands unless topography blocked visibility of a site (Map 3.10-1). That condition was consistent with the Pinedale RMP (BLM, 1988b) which authorized that no surface disturbance would be allowed within one-quarter mile or the visual horizon (whichever is closer) of contributing segments of the historic trails. In the PAPA DEIS (BLM, 1999a), the 0.25-mile buffer and the viewshed (up to a distance of 3 miles on each side of the trail) of the Lander Trail were defined as the Lander Trail SRMZ, in which intrusions visible from approximately 3 miles of the trail's centerline could adversely affect its visual setting (Map 3.10-1). As originally conceived in the PAPA DEIS (BLM, 1999a), the Lander Trail SRMZ (Map 3.10-1) occupies approximately 22,900 acres or 12 percent of the PAPA (Table 3.10-1).

Table 3.10-1
Estimated Existing Wellfield Disturbance in Relation to the Lander Trail SMRZ and Viewshed

Lander Trail SRMZ Category	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Lander Trail 0.25-mile Buffer	3,978	60.5	6.8	67.3	1.7
Lander Trail SRMZ (PAPA DEIS)	22,893	480.1	52.7	532.8	2.3
Lander Trail Viewshed (PAPA ROD)	18,105	351.9	36.2	388.1	2.1



Map 3.10-1
Existing Wellfield Disturbance
in Relation to the Lander Trail, Viewshed, Buffers,
and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Lander Trail
3-Mile Buffer, Areas Visible from Lander Trail
0.25-Mile Buffer, No Surface Occupancy as Needed
Lander Trail Viewshed
Lander Trail Sensitive Resource Management Zone (Areas Visible Only)
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

The concept of the Lander Trail SRMZ and Lander Trail viewshed were modified in the PAPA FEIS (BLM, 2000a) and PAPA ROD (BLM, 2000b) as both were incorporated into MA 1 for which the management objective is to preserve the integrity of the Lander Trail and Lander Trail Viewshed. The Lander Trail Viewshed was redefined in the PAPA ROD to include areas beyond the 0.25-mile protective buffer that would be visible up to 3 miles north of the trail and south of the trail to State Highway 351 (Map 3.10-1). To achieve the objective, BLM would require case-by-case visibility analyses to minimize visual intrusions by wellfield development to the greatest extent practicable. To that end, a pilot project was initiated in 2003 which identified ten Key Observation Points (KOPs) along 8 miles of the trail. In 2005, BLM and SHPO signed an "Assistance Agreement" for the Lander Trail Viewshed Monitoring Project, budgeted through 2006, to include photography from each KOP. The photography was intended for future display and used to evaluate approaches to concealing wellfield developments (Vlcek, 2006 and Trautman, 2006).

As of December 2005, approximately 480 acres had been disturbed within the entire Lander Trail SRMZ (defined in the PAPA DEIS) of which approximately 61 acres were within the 0.25-mile buffer of the Lander Trail (Table 3.10-1). That disturbance includes well pads, roads (upgrading three collector roads: the Paradise Road, Boulder South Road, and Middle Crest Road), and pipelines. In 2005, 352 acres had been disturbed by wellfield development within the Lander Trail Viewshed (defined in the PAPA ROD) with another 36 acres of disturbance projected for 2006 (Table 3.10-1). Although the Lander Trail setting and viewshed have been compromised by these surface disturbances, intact portions of the trail are found immediately adjacent to the disturbances. In spring 2006, Nielson (formerly Petrogulf) constructed a well pad approximately 100 feet from the trail, significantly impacting the trail on State of Wyoming land in Section 36, T. 31 N., R. 109 W. (Vlcek, 2006).

3.10.1.5 Programmatic Agreements

A segment of the Lander Trail is currently managed under a PA between BLM, the Wyoming SHPO, the Advisory Council on Historic Preservation, Shell, and Ultra, to maintain the integrity of the trail (see Appendix H). Other parts of the PA require public education exhibits for the trail. These elements are currently being developed (Vlcek, 2006). The PA does not include other operators developing near the Lander Trail, and they are responsible for creating their individual mitigation or management plans.

The PAPA DEIS (BLM, 1999a) included the outline for a Jonah Field-Anticline-wide PA which was signed by the original PAPA Operators and resource management agencies. The PA required synthesis of archaeological data, development of a cultural resource management plan, and development of a treatment/mitigation plan for cultural resources in the PAPA, within 1 year of the signing of the PA and established deadlines for these documents. For various reasons, the operators did not meet the deadlines set forth in the PA, and it expired automatically (Vlcek, 2006).

In 2005, the Cultural/Historic Task Group of the PAWG researched the DEIS PA to assess the possibility of creating a new general PA for the PAPA. In cooperation with the BLM, the Task Group found that the revised Wyoming Protocol Agreement (see Appendix G), a document that describes how the Wyoming SHPO and BLM will consult on cultural resource management (though not specific to the PAPA), was sufficient enough to protect resources in the PAPA. The Task Group determined that the Wyoming Protocol streamlines archeological resource management, and that a new PA would be unnecessary.

Because there are several Operators in the PAPA, obtaining consensus on the extremely varied cultural resource management has proven difficult (Vlcek, 2006). Further, the different geographic settings within the PAPA contain significantly different types of cultural resources.

For example, the northern end of the Mesa and sensitive soils identified in the PAPA DEIS (BLM, 1999a) in the Mesa Breaks contain numerous Native American sites. Cultural resources discovered near the New Fork River have been discussed, above. Leaseholds within the Blue Rim Area have encountered conflicts over specific archeology and paleontological materials found there (see Paleontological Resources, below). The south end of the PAPA is an area of complex archeological discoveries such as the New Fork Wagon Road (NRHP eligible).

3.10.2 Pipeline Corridors and Gas Sales Pipelines

3.10.2.1 Cultural History Overview

Cultural resources in the areas crossed by the proposed corridor/pipeline alignments consist of sites from prehistoric and historic time periods. The prehistoric period extends from approximately 12,000 years before present (B.P.) through 350 B.P., when Europeans began to arrive in the Green River Basin. Approximately 75 percent of the sites found in the Green River Basin are prehistoric. Artifacts from prehistoric times include projectile points, grinding slabs, pottery, and evidence of camp sites (BLM, 1997).

Historic trails to be crossed by the proposed corridors/pipeline alignments include the Oregon Trail, the Oregon Trail/Pony Express Route, the East Bank Kinney Cutoff, the Baker-Davis Road/Slate Creek Cutoff, the Sublette Cutoff, the Lander Cutoff, and the Opal Wagon Road.

3.10.2.2 Cultural Resource Inventory

Past and ongoing cultural resource inventories provide information on cultural resources present within the BCC, BFGC, and OPC (Stainbrook, 2006). Class I and III inventories for portions of the proposed BCC, BFGC, and OPC and adjacent lands, have been completed or are ongoing. The field survey of the R6 Pipeline is near completion. Eligibility testing for nomination to the NRHP has been initiated. Survey and testing of sites in temporary use areas is planned. The archaeological landscape, a secondary lithic procurement site, is documented along the proposed corridor/pipeline alignments. The landscape is not eligible for listing in NRHP.

Previously identified sites between the Pinedale/Gobblers Knob and Paradise compressor stations and the Bird Canyon Compressor Station include 17 not eligible, 10 eligible, and six unevaluated prehistoric camps; seven not eligible and four unevaluated lithic scatters, one not eligible historic road, one eligible prehistoric camp historic debris scatter, and one unevaluated lithic and historic debris scatter. Also documented is the Lander Cutoff of the Oregon Trail.

Previously identified sites located between the Bird Canyon Compressor Station and the Blacks Fork Processing Plant include one railroad, 17 eligible and 37 not eligible prehistoric camps, four not eligible prehistoric archaeological landscapes, one not eligible lithic scatter, and one not eligible can scatter. Not included in the above total are five not eligible prehistoric camps destroyed by past construction. Also documented are the Oregon Trail, the Pony Express, the East Bank Kinney Cutoff, the Baker-Davis Road/Slate Creek Cutoff, and the Sublette Cutoff of the Oregon Trail.

Previously identified sites located between the Bird Canyon Compressor Station and Opal Gas Processing Plant include three eligible historic trails (Baker-Davis Road/Slate Creek Cutoff, the East Bank Kinney Cutoff, and the Sublette Cutoff), the eligible Opal Wagon Road, one not eligible river crossing, one not eligible historic debris scatter, eight eligible and 32 not eligible prehistoric camps, three not eligible prehistoric camps with historic debris, six not eligible lithic scatters, and one not eligible lithic and historic debris scatter. Eight sites have been destroyed, including seven not eligible prehistoric camps and one not eligible cairn.

Additional field work conducted beyond the initial Class III survey would include staging areas located outside the pipeline survey and testing for eligibility for nomination to the NRHP. Not included in the above total are 15 not eligible prehistoric camps, five lithic scatters, and one historic debris site destroyed by past construction.

3.10.2.3 Native American Concerns

Native American tribes, including the Ute, Arapahoe, Cheyenne, Shoshone, and Shoshone-Bannock, have had tribal territories located in the general area of the proposed corridor/pipeline alignments.

3.11 AIR QUALITY

3.11.1 Air Quality Monitoring Data

The affected environment described below for air quality includes a large portion of southwestern Wyoming and surrounding areas. The discussion below is for proposed development within the PAPA and for the proposed construction of the natural gas pipelines.

The Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based standards for the maximum concentration of air pollutants at all locations to which the public has access. Although specific air quality monitoring has not been conducted for the PAPA, air quality monitoring for the regional pollutants of concern has been determined to be representative of the PAPA. Measured air pollutants for which ambient air quality standards exist include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in effective diameter (PM_{10}), particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Monitored concentrations for these pollutants are compared to the WAAQS and NAAQS in Table 3.11-1. The PAPA is designated as attainment for all criteria pollutants.

Greenhouse gases (carbon dioxide (CO_2) and methane (CH_4)) refer to the category of air emissions that have the potential to change the climate. These emissions are typically emitted from combustion activities or are directly emitted into the atmosphere. Currently, Wyoming Department of Environmental Quality–Air Quality Division (WDEQ-AQD) does not have regulations regarding greenhouse gas emissions, although these emissions are regulated indirectly by various other regulations for other pollutants.

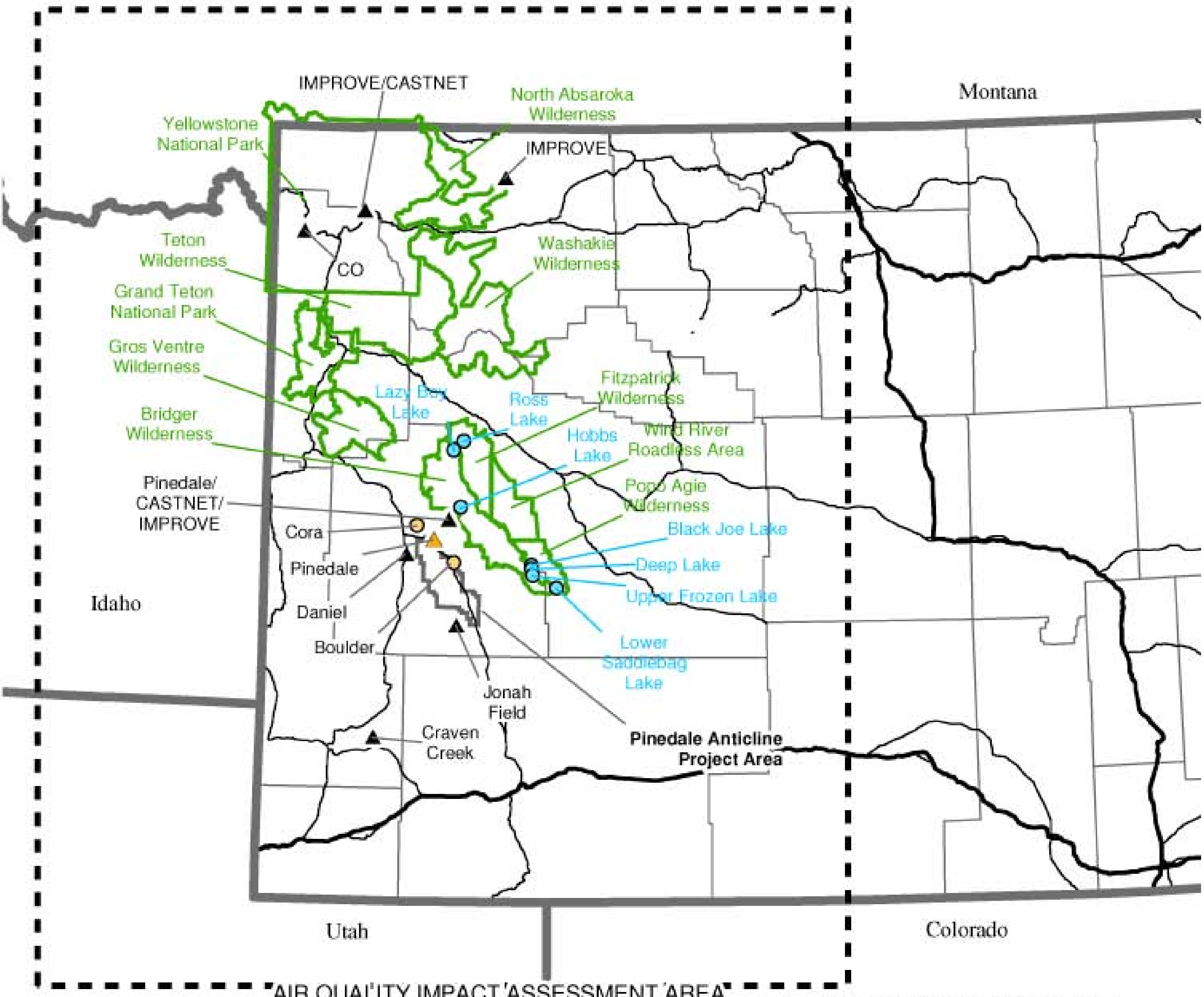
Regional pollutants of concern have been monitored at several sites within Sublette County adjacent to the PAPA. The locations are within the Jonah Field, at the eastern edge of the PAPA near Boulder, and northwest of Pinedale near Daniel. The Boulder site has been in operation since September 2004, the Jonah Field site began operation in November 2004, and the Daniel site began operation in July 2005. The locations of these sites in relation to the PAPA are illustrated in Map 3.11-1. Background concentrations are used as an indicator of existing conditions in the region, and are assumed to include emissions from industrial sources in operation and from mobile, urban, biogenic, and other non-industrial emission sources. The Boulder site, which is at the eastern edge of the PAPA, is considered by the WDEQ-AQD as most representative of background conditions within the PAPA. The monitoring data available for all three Sublette County sites are provided in Table 3.11-1. The data collected at the Jonah Field and Daniel sites are provided here for reference purposes. Monitored background values are in compliance with ambient air quality standards (Table 3.11-1), although concentrations equal to the level of the 8-hour ozone standard have been measured at the Boulder site.

Table 3.11-1
Air Pollutant Background Concentrations and
Wyoming and National Ambient Air Quality Standards (ug/m^3)

Pollutant	Monitoring Site	Averaging Time	Measured Background Concentration	Wyoming and National Ambient Air Quality Standards
Carbon monoxide (CO)	Yellowstone National Park[1]	1-hour	1,979	40,000
		8-hour	931	10,000
Nitrogen dioxide (NO_2)	Jonah Field [2] Boulder [3] Daniel [4]	Annual	19 8 6	100
Ozone (O_3)	Jonah Field [2] Boulder [3] Daniel [4]	8-hour [5]	149 157 145	157[6]
Particulate matter (PM_{10})	Jonah Field [2] Boulder [3] Daniel [4]	24-hour [7]	51 32 23	150
	Jonah Field [2] Boulder [3] Daniel [4]	Annual	10 9 9	50
Particulate matter ($PM_{2.5}$) [7]	Pinedale [8]	24-hour [7]	15	65 (35)[9]
		Annual	6	15
Sulfur dioxide (SO_2) [8]	Craven Creek [10]	3-hour	132	1,300
		24-hour	43	365 (NAAQS) 260 (WAAQS)
		Annual	9	80 (NAAQS) 60 (WAAQS)

[1] Background data collected during 2005 in Yellowstone National Park, Wyoming, monitoring site near "Old Faithful."
[2] Background data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005.
[3] Background data collected approximately 5 miles southwest of Boulder, Sublette County, Wyoming. Values are based on one year of data collected during (April 2005 through March 2006).
[4] Background data collected approximately 5 miles south of Daniel, Sublette County, Wyoming off Hwy. 18. Values are based on 1 year of data collected during July 2005 through June 2006.
[5] Highest, fourth highest monitored value.
[6] Ambient Air Quality Standard is based on the 3 year average of the yearly fourth highest 8-hour concentrations. An area is in compliance with the standard if the fourth highest 8-hour ozone concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
[7] Highest, 98th percentile monitored value.
[8] Background data collected in Pinedale, Wyoming. Values are based on 1 year of data collected during July 2005 through June 2006.
[9] Proposed new National Ambient Air Quality Standard. An area is in compliance with the standard if the 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
[10] Background data collected at the LaBarge Study Area/Northwest Pipeline Craven Creek site in 1982-1983.

Map 3.11-1
Air Quality Impact Assessment Area Showing Locations of Sensitive Areas, Midfield Communities, and Monitoring Sites



Distances to Sensitive Areas at the Closest Point	
Sensitive Area	Distance to PAPA (km / mi)
Bridger Wilderness Area	11 / 7
Fitzpatrick Wilderness Area	27 / 17
Gros Venture Wilderness Area	48 / 30
Popo Agie Wilderness Area	34 / 21
Wind River Wilderness Area	34 / 21
Grand Teton National Park	96 / 59
Teton Wilderness Area	96 / 60
North Absaroka Wilderness Area	171 / 106
Yellowstone National Park	135 / 84
Washakie Wilderness Area	91 / 56

Sensitive Area Boundary
Sensitive Lakes
Midfield Communities
Monitoring Sites; North Absaroka
Midfield Community and Monitoring Site

0 10 20 30 40 50 100 150 Miles

N

No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

Federal air quality regulations adopted and enforced by WDEQ-AQD limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. PSD Increments are defined for NO_2, SO_2 and PM_{10}. The incremental increase depends upon an area's classification. Seven PSD Class I areas are identified as sensitive areas in the modeling domain: the Bridger, Fitzpatrick, North Absaroka, Teton, and Washakie Wilderness Areas, and Grand Teton and Yellowstone National Parks (see Map 3.11-1). Strict limitations on the additional amount of air pollution in PSD Class I areas, associated with major emitting facilities, are applied. The remainder of the modeling domain is classified PSD Class II, where similar but less stringent incremental air quality limits apply. The Gros Ventre and Popo Agie Wilderness Areas and the Wind River Roadless Area are PSD Class II areas that have been identified as additional sensitive areas occurring within the modeling domain for air quality. PSD Class I and sensitive PSD Class II areas are shown in Map 3.11-1 as sensitive areas. The PSD Class I and Class II Increments are provided in Table 3.11-2.

Table 3.11-2
Prevention of Significant Deterioration (PSD) Increments (ug/m^3)

Pollutant	Averaging Time	Incremental Increase Above Legal Baseline	
		PSD Class I	PSD Class II
Nitrogen dioxide (NO_2)	Annual	2.5	25
	3-hour	25	512
Sulfur dioxide (SO_2)	24-hour	5	91
	Annual	2	20
Particulate matter (PM_{10})	24-hour	8	30
	Annual	4	17

The 1977 Clean Air Act amendments established visibility as an Air Quality Related Value (AQRV) that federal land managers must consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I areas. Residents of the Pinedale area consider visibility impairment to be a major concern.

There are two types of visibility impairment caused by emission sources: plume impairment and regional haze. Plume impairment occurs when a section of the atmosphere becomes visible due to the contrast or color difference between a discrete pollutant plume and a viewed background such as a landscape feature. Regional haze occurs when pollutants from more diffuse emission sources become well mixed in the atmosphere, causing a general alteration in the appearance of landscape features, changing the color or contrast between landscape features, or causing features of a view to disappear. Regional haze is caused by light scattering and light absorption by fine particles and gases.

Visibility impairment is measured in terms of change in light extinction or change in deciview (dv). Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change in visibility" when compared to background conditions. A dv change of 1.0 or 2.0 (equivalent to a 10 percent and 20 percent change in extinction) represents a small but perceptible change in visibility. The BLM considers a 1.0 dv change to be a significance threshold for visibility impairment, although there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies use a 0.5 dv change as a screening threshold for significance.

Visual range, referred to as standard visual range (SVR), is the farthest distance at which an observer can just see a black object viewed against the horizon sky; the larger the SVR, the cleaner the air. Visibility conditions can be measured in SVRs (miles). Visibility within the PAPA air quality modeling domain is considered very good, with an average SVR of over 93.2 miles (Malm, 2000).

Visibility and atmospheric deposition are monitored within PSD Class I areas. In 1985, the Interagency Monitoring of Protected Visual Environments (IMPROVE, 2006) monitoring program was initiated to establish current visibility conditions, to track visibility changes, to establish long-term trends, and to determine the causes of visibility impairment in PSD Class I areas. The Bridger Wilderness Area, North Absaroka Wilderness Area, and Yellowstone National Park IMPROVE sites are the closest such sites to the PAPA. Data have been collected near the Bridger Wilderness Area and Yellowstone National Park sites since 1989 and at the North Absaroka Wilderness Area since 2002. Figures 3.11-1, 3.11-2, and 3.11-3 show SVRs at the IMPROVE sites for the cleanest days (20th percentile best visibility days); for 20th percentile middle conditions; and for the haziest days (20th percentile haziest visibility days), respectively (IMPROVE, 2006). SVRs were reconstructed from monitored aerosol (suspended liquid or solid particles) data.

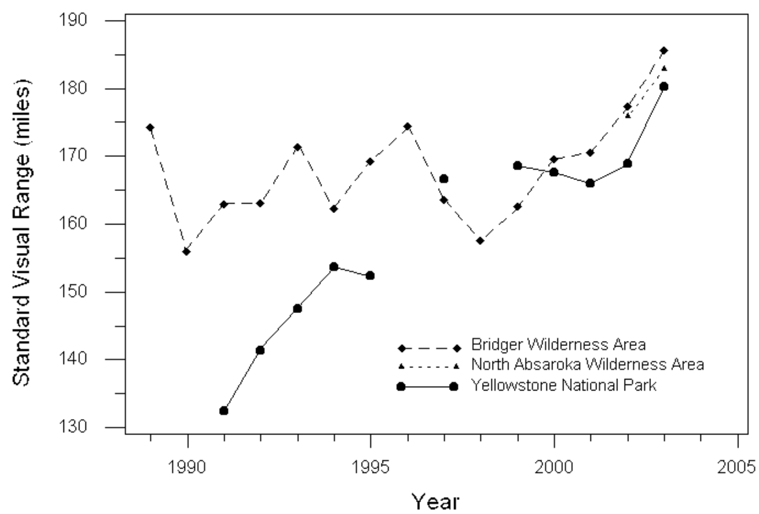


Figure 3.11-1
Standard Visual Range (SVR) for 20th % Cleanest Days, Pinedale Anticline Project Area, Sublette County, Wyoming (IMPROVE, 2006)

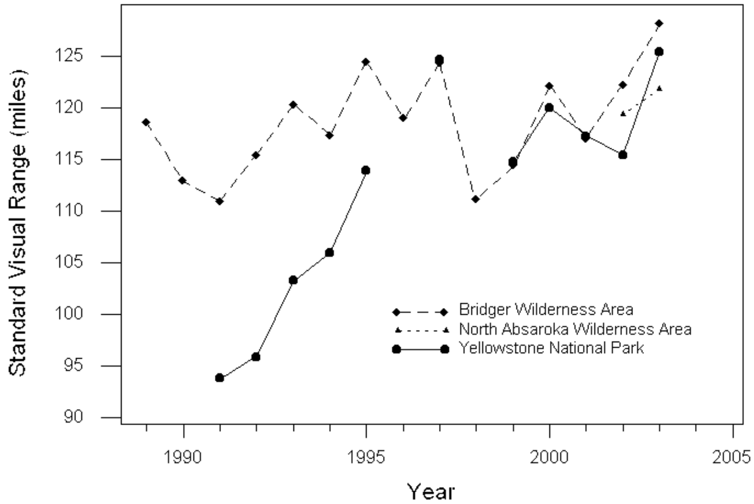


Figure 3.11-2
Standard Visual Range (SVR) for 20th % Middle Days, Pinedale Anticline Project Area, Sublette County, Wyoming (IMPROVE), 2006

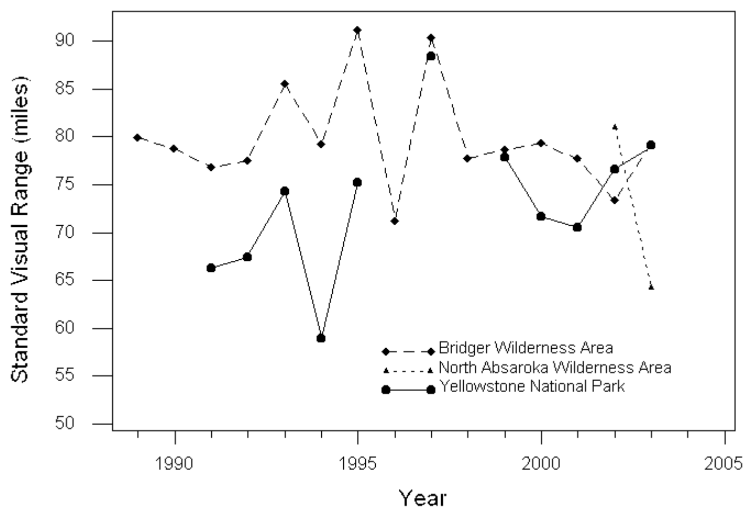


Figure 3.11-3
Standard Visual Range (SVR) for 20th % Haziest Days, Pinedale Anticline Project Area, Sublette County, Wyoming (IMPROVE, 2006)

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and it is reported as the mass of material deposited on an area per year (kg/ha-yr). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of pollutants). The chemical components of wet deposition include sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4), and the chemical components of dry deposition include SO_4, SO_2, NO_3, NH_4, and nitric acid (HNO_3). Near Pinedale, the National Acid Deposition Program (NADP) and National Trends Network (NTN) station monitors wet atmospheric deposition and the Clean Air Status and Trends

Network (CASTNET) station monitors dry atmospheric deposition. Figures 3.11-4 and 3.11-5 show the total annual background deposition (wet and dry) reported as total nitrogen (N) and total sulfur (S) deposition for these sites for the monitoring period of record through 2004. These figures also provide the contributions of each measured chemical component to the total deposition values.

Total deposition levels of concern (LOC) have been established for several areas, including the Bridger Wilderness Area (USFS, 1989). The "red line" LOC represents an estimate of the total pollutant loadings that each wilderness can tolerate. If an analysis done under FLAG guidelines indicates total loadings above these values, it may be suggested that the land manager recommend a reduction of emissions from new sources unless data are available to indicate that no AQRVs in the PSD Class I area are likely to be adversely affected. The "green line" LOC represents the total pollution loadings (current plus proposed new source contribution) below which a land manager can recommend a permit be issued for a new source, unless data are available that indicate otherwise. The USFS has indicated that the current green line values are set too high and do not adequately protect ecosystems from nitrogen and sulfur deposition (Svalberg, 2006). Cumulative impacts plus background are compared to these LOCs. The Bridger Wilderness sulfur deposition red line LOC is 20 kg/ha-yr and sulfur deposition green line is 5 kg/ha-yr. The Bridger Wilderness nitrogen deposition red line LOC is 10 kg/ha-yr and nitrogen deposition green line LOC is 3-5 kg/ha-yr. For comparison with reported values from the Pinedale stations, the Bridger Wilderness LOCs are shown on Figures 3.11-4 and 3.11-5.

Figure 3.11-4
Mean Annual Total Sulfur Deposition near Pinedale, Wyoming

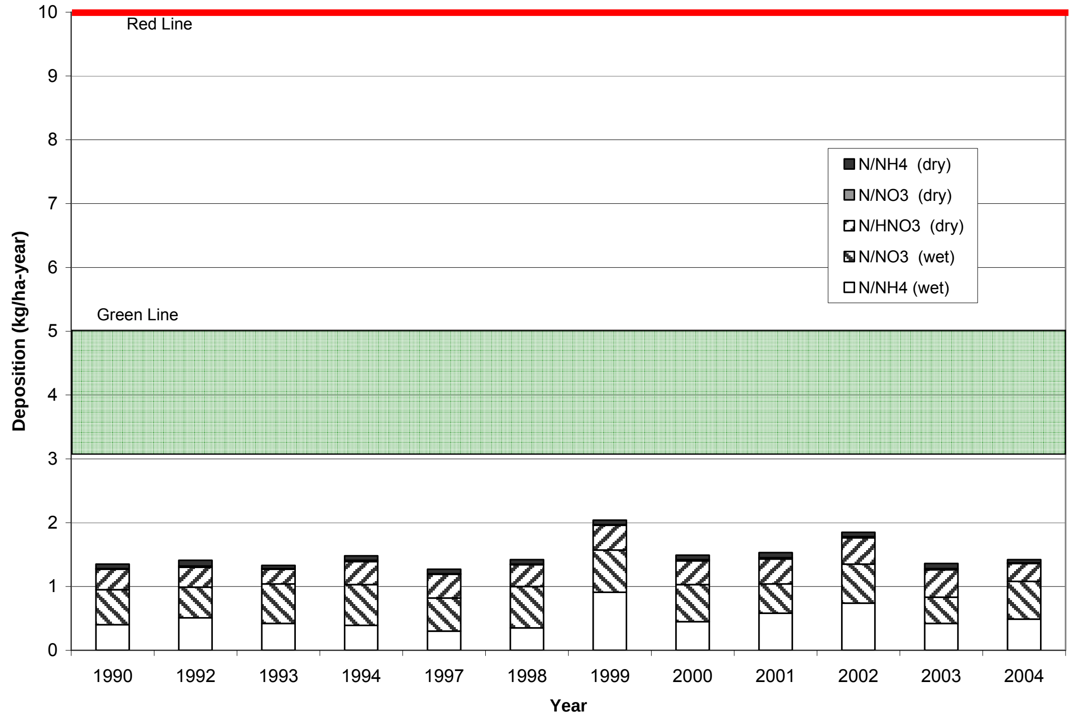


Figure 3.11-5
Mean Annual Total Nitrogen Deposition near Pinedale, Wyoming

Site-specific lake chemistry background data (pH, acid neutralizing capacity - ANC, elemental concentrations, etc.) have been collected by the USFS in several high mountain lakes in the nearby Wilderness Areas. Lakes considered sensitive to acid deposition for which background data were collected are shown on Map 3.11-1. Lake acidification is measured in terms of change in ANC, which is the lake's buffering capacity to resist acidification from atmospheric deposition of acid compounds such as sulfates and nitrates. Measured background ANC data for sensitive lakes within the modeling domain are provided in Table 3.11-3.

Table 3.11-3
Monitored Background Conditions at Sensitive Lakes[1]

Sensitive Lake	Lake Location	Background ANC (µeq/l)[2]	Number of Samples	Period of Monitoring
Black Joe Lake	Bridger Wilderness Area	67.1	67	1984-2005
Deep Lake	Bridger Wilderness Area	59.7	64	1984-2005
Hobbs Lake	Bridger Wilderness Area	69.9	71	1984-2005
Lazy Boy Lake	Bridger Wilderness Area	10.8	3	1997-2004
Upper Frozen Lake	Bridger Wilderness Area	6.0	8	1997-2005
Ross Lake	Fitzpatrick Wilderness Area	53.7	49	1988-2005
Lower Saddlebag Lake	Popo Agie Wilderness Area	55.2	48	1989-2005

[1] Source: USFS, 2006.
[2] 10th percentile lowest ANC values reported.

The USFS considers lakes with ANC values greater than 25 microequivalents per liter (µeq/l) to be sensitive to atmospheric deposition and lakes with ANC values less than or equal to 25 µeq/l are considered extremely sensitive. Of the seven lakes identified by the USFS as acid sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid sensitive.

The USFS has identified a specific methodology to determine acceptable changes in ANC, which are used to evaluate potential air quality impacts from deposition at acid sensitive lakes (USFS, 2000). The USFS has established a level of acceptable change (LAC) of no greater than a 1 µeq/l change in ANC (from human causes) for lakes with existing ANC levels less than or equal to 25 µeq/l. A limit of 10 percent change in ANC reduction was adopted for lakes with an ANC greater than 25 µeq/l.

3.11.2 Impacts to Air Quality from Existing Wellfield Activities

Potential impacts to air quality resulting from exploration and development of natural gas within the PAPA were previously analyzed in the PAPA DEIS (BLM, 1999a). Since issuance of the PAPA ROD (BLM, 2000b) in July 2000, natural gas development within the PAPA has occurred at a pace greater than was analyzed in the PAPA DEIS. The PAPA ROD authorized the development of 700 producing wells or well pads (see Chapter 1, Section 1.3) and set thresholds of 376.59 tpy of NO_x emissions from compression, and 693.5 tpy of NO_x emissions from all sources in the field. The air quality impact analysis conducted in the PAPA DEIS assumed 700 producing wells and up to eight drilling rigs operating in the PAPA at any one time. As of December 2005, there were approximately 457 producing wells and over 26 drilling rigs operating in the PAPA. However, 29 of the producing wells were drilled prior to the PAPA ROD. The NO_x emissions from all sources operating in the PAPA during year 2005 were estimated at 3,512.4 tpy which exceeds the 693.5 tpy analysis threshold specified in the PAPA ROD (BLM, 2000b).

Many of the air quality monitoring data presented in Section 3.11.1 are representative of year 2005, and therefore, include some level of pollutant impacts resulting from wellfield activities that occurred within the PAPA during 2005. However, air quality impact analysis modeling has not been performed for the current level of development. Due to concerns that the monitoring network may not be sufficient for quantifying the maximum impacts that occur from the PAPA, modeling has been performed to estimate the air quality impacts of the year 2005 for PAPA wellfield activities. This analysis was performed primarily to estimate impacts to visibility (regional haze), atmospheric deposition, and to ambient concentrations of NO_2, SO_2, PM_{10}, and $PM_{2.5.}$ These are the AQRVs and ambient concentrations for which recent monitoring data near the PAPA are available.

An inventory of actual criteria pollutant and hazardous air pollutant (HAP) emissions from construction (due to potential surface disturbance by earthmoving equipment, vehicle traffic, fugitive dust, well completion and testing, and drilling rig and vehicle engine exhaust), production (production equipment, compression engine exhausts, vehicle traffic engine exhausts, and fugitive dust), and other ancillary facilities was developed for year 2005. Criteria pollutant emissions include NO_x, CO, SO_2, VOCs, PM_{10} and $PM_{2.5}$. HAPs consist of n-hexane, benzene, toluene, ethylbenzene, and xylene (BTEX) and formaldehyde. Total criteria pollutant and HAP emissions from the PAPA for year 2005 are summarized in Table 3.11-4. Although emissions have been quantified for all criteria pollutant and HAPs, the year 2005 modeling analysis of actual project emissions was only performed for NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions. NO_x, SO_2, and PM_{10}/$PM_{2.5}$ emissions are precursors to regional haze formation, whereas NO_x, and SO_2 emissions impact acid deposition. Detailed information regarding the 2005 actual emission inventory and the air quality impact analyses are provided in the Air Quality Impact Analysis Technical Support Document (Air Quality TSD).

Table 3.11-4
Pinedale Anticline Project Pollutant Emissions for Year 2005

Pollutant	Summer (lb/hour)	Winter (lb/hour)	Total (tons/year)
Nitrogen oxides (NO_x)	863.1	798.4	3,512.4
Sulfur dioxide (SO_2)	54.4	53.0	231.8
Carbon monoxide (CO)	723.9	624.7	2,745.7
Volatile Organic Compounds (VOCs)	580.7	568.9	2,494.3
Particulate matter (PM_{10})	532.0	145.3	1,199.0
Particulate matter ($PM_{2.5}$)	156.7	64.3	401.4
Formaldehyde	9.5	9.5	41.7
Benzene	16.6	16.6	72.7
Toluene	28.6	28.6	125.4
Ethylbenzene	8.5	8.5	37.1
Xylene	18.0	18.0	78.9
n-Hexane	8.8	8.8	38.5

The year 2005 air quality analysis utilized the actual emissions estimates and the EPA CALMET/CALPUFF modeling system to predict maximum potential air quality impacts at mandatory federal PSD Class I and other sensitive PSD Class II areas (far-field locations), as well at designated acid sensitive lakes within these areas. The analysis includes an assessment of impacts at mid-field locations (regional communities of Boulder, Cora, and Pinedale), and at in-field locations within the PAPA. The analyzed areas are shown on Map 3.11-1.

For this analysis, 3 years (2001, 2002, and 2003) of hourly windfields were developed with the CALMET meteorological model for the modeling domain (Map 3.11-1). The CALPUFF dispersion model was used to model actual NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions for each year of meteorology to estimate maximum potential in-field (within the PAPA) ambient air pollutant concentrations, as well as maximum ambient air pollutant concentrations, visibility (regional haze), and atmospheric deposition impacts at the sensitive (far-field) PSD Class I and Class II areas. Maximum visibility impacts were also determined for the (mid-field) regional communities of Boulder, Cora, and Pinedale. Detailed information regarding the modeling methodologies used in the analysis is provided in the Air Quality TSD.

Predicted pollutant concentrations were compared to applicable ambient air quality standards and to PSD Class I and Class II increments, and were used to assess potential impacts to visibility (regional haze) at PSD Class I and sensitive PSD Class II areas. Ambient background concentrations were added to modeled concentrations for comparison to ambient air quality standards. Ambient background concentrations were not added to modeled concentrations for comparison to PSD Class I and II Increments. All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD increment consumption analysis.

Predicted changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled concentration impacts to background visibility conditions representative of each PSD Class I or sensitive PSD Class II area. At the request of the BLM, WDEQ, and USFS three separate methods were performed using two different representations of background visibility conditions. Two additional visibility methods which follow recent CALPUFF modeling guidance for Best Available Retrofit Technology (BART) analyses developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization (RPO) were also performed (VISTAS, 2006).

The BLM and USFS methods use visibility values provided in the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Report for each Class I area to represent natural background visibility. The WDEQ method uses representative monitoring data, for the quarterly average of the 20 percent best visibility days, collected from the IMPROVE network for the time period (2000 to 2004) which coincides with the time period that will be used to establish "baseline conditions" under the EPA Regional Haze Rule (EPA, 2003a). The two BART methods use background visibility conditions representative of each Class I area as provided in the Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule (EPA, 2003b).

Visibility impacts for the BLM method are presented herein compared to the BLM 1.0 dv change threshold. All other visibility impact analyses and comparisons are detailed and presented in the Air Quality TSD.

Changes in regional haze at the Wyoming regional community locations (Boulder, Cora, and Pinedale) were predicted using CALPUFF modeled impacts and recent (year 2005-2006) background visibility data collected at Boulder. Visibility impacts were compared to the BLM 1.0 dv change threshold. Visibility impacts within regional community locations are not regulated by state or federal agencies.

Impacts to nitrogen and sulfur deposition at PSD Class I and sensitive PSD Class II areas were predicted by CALPUFF and were added to background nitrogen and sulfur deposition values to compare to total deposition LOC. The predicted nitrogen and sulfur deposition values at acid sensitive lakes were used to estimate change in ANC to compare to LAC.

Table 3.11-5 presents a summary of maximum predicted impacts to air quality from the 2005 wellfield development in the PAPA. The modeled impact values are provided in Appendix I Tables I.1 through I.13. The results summary shown in Table 3.11-5 and the predicted impacts provided in Appendix I represent maximum CALPUFF modeled impacts that were predicted using 3 years (2001-2003) of CALMET meteorological data.

Table 3.11-5
Summary of 2005 Air Quality Impacts from Wellfield Activities in the PAPA

Air Quality Impact	Predicted Impact Summary
Increased concentrations of NO_2, SO_2, PM_{10} and $PM_{2.5}$	Predicted concentrations are in compliance with applicable National Ambient Air Quality Standards and Wyoming Ambient Air Quality Standards at all locations; predicted near-field concentrations of PM_{10} are above the PSD 24-hour PM_{10} increment, annual PM_{10} increment, and the NO_2 increment; and below the PSD increments for SO_2; predicted far-field concentrations are below PSD increments[1]
Increased visibility (regional haze) at PSD Class I and sensitive PSD Class II areas (far-field)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 45 days per year at the Bridger Wilderness, 5 days at the Fitzpatrick Wilderness, 1 day at Grand Teton National Park, 2 days at the Gros Ventre Wilderness, 6 days at the Popo Agie Wilderness, 6 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas
Increased visibility (regional haze) (mid-field communities)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 108 days per year at Boulder, 36 days at Cora, and 55 days at Pinedale
Increased atmospheric/terrestrial deposition	Predicted Impacts from sulfur and nitrogen deposition are less than the total deposition LOC at all analyzed areas
Increased sensitive lake ANC	Predicted impacts are less than the LAC at all acid sensitive lakes

3.12 NOISE

Noise measurements taken at several locations across the PAPA prior to issuance of the PAPA ROD (BLM, 2000b) indicate that background noise is similar to EPA's category of "Farm in Valley" (EPA, 1971). The background noise levels (decibels on the A-weighted scale or dBA) for that category are: daytime - 39 dBA; evening - 39 dBA; and nighttime - 32 dBA. Local conditions such as traffic, topography, and high winds characteristic of the region can alter background noise conditions. The PAPA DEIS (BLM, 1999a) identified the following areas as being noise-sensitive; greater sage-grouse leks; crucial big game habitat during critical periods; residences within and adjacent to the PAPA; areas adjacent to the Lander Trail; ranches along both the New Fork and Green rivers; occupied raptor nest sites; and recreation areas. The PAPA ROD set noise limits on new wellfield developments, specifically compressor sites and "other long-term" facilities, so that distance to a dwelling or a greater sage-grouse lek would be sufficient to result in no noise level increase at the dwelling and would not result in a noise level increase greater than 10 dBA above background at the edge of a greater sage-grouse lek.

Appendix A in the Decision Record for the ASU Year-Round Drilling Demonstration Project (BLM, 2005b) set a performance based objective for the ASU Operators to "maintain noise levels at 75 dBA or less measured 30 feet from the noise source (drilling rig, compressor, etc.)." Winter drilling was allowed under the Decision Record, and Ultra and Shell monitored noise levels. Noise was measured at each of the four principal compass points at 35 feet from the edge of each of three well pads subject to winter drilling over a 5 to 8 day monitoring period. Noise measurements included total noise from drilling by two drilling rigs per pad, as well as noise generated by other activities associated with drilling (tripping pipe, short-tripping at casing depth, running casing, cementing, and circulating) and other equipment entering and operating on pads (high vacuum trucks, cement trucks, mud transport trucks, wireline trucks, backhoes, front-end loaders, rigging trucks, process cuttings equipment, air compressor blow down, general truck traffic with engine breaking, pipe inspection equipment, welding equipment, and grinding equipment). Because the noise monitors were located 35 feet from the edge of the well pads, it is impossible to separate noise generated by drilling from noise generated by other sources.

The noise monitoring station locations, while 35 feet from the edge of each well pad, were farther than that from the actual noise sources. The distance from drilling rig engines, which produced the most consistent noise, to noise monitoring stations varied from 184 feet to 811 feet (Table 3.12-1).

Table 3.12-1
Noise Measurements (dBA) at Three of ASU's Well Pads with Winter Drilling by Two Rigs per Pad During Winter 2006[1]

Well Pad	Measured at North Monitoring Point		Measured at South Monitoring Point		Measured at East Monitoring Point		Measured at West Monitoring Point	
	Average Noise (dBA)	Distance to nearest Engine [2]	Average Noise (dBA)	Distance to nearest Engine [2]	Average Noise (dBA)	Distance to nearest Engine [2]	Average Noise (dBA)	Distance to nearest Engines [2]
Ultra Mesa 7-34	57.2	346 feet	62.9	237 feet	58.4	184 feet	54.7	811 feet
Ultra Mesa 9C-35D [3]	62.2	337 feet	69.9	255 feet	65.8	262 feet	64.4	255 feet
Shell Mesa 7-29	55.4	340 feet	58.5	356 feet	53.7	364 feet	55.2	308 feet

[1] ENSR, 2006a, 2006b, and 2006c.
[2] Distance from the noise monitoring point to the nearest drill rig engine was measured from scaled well pad plot plans.
[3] Engine locations were not shown on Ultra's Mesa 9C-35D pad; distance was measured to each rig location.

Distances to noise monitoring stations and the associated average noise at each monitoring station in Table 3.12-1 can be used to estimate the distance from the rig engines at which the engine noise would attenuate to EPA's "Farm in Valley" background level of 39 dBA. Assuming that only one engine assembly generated noise on a pad and that noise was attenuated by 6 dBA for every doubling of distance from the source, the distances at which engine noise would approximate background noise would range from 1,717 feet to 8,944 feet (Table 3.12-2). With the same assumptions, the distances at which engine noise would attenuate to 49 dBA (10 dBA above background) at noise-sensitive sites (dwellings, greater sage-grouse leks) defined in the PAPA ROD range from 543 feet to 2,828 feet.

Table 3.12-2
Distances Noise Would Attenuate to Background (39 dBA) and PAPA ROD Limits at Noise-Sensitive Locations (49 dBA) from ASU Drilling Rigs

Well Pad	Attenuation Distance from North Monitoring Point (feet)		Attenuation Distance from South Monitoring Point (feet)		Attenuation Distance from East Monitoring Point (feet)		Attenuation Distance from West Monitoring Point (feet)	
	39 dBA	49 dBA	39 dBA	49 dBA	39 dBA	49 dBA	39 dBA	49 dBA
Ultra Mesa 7-34	2,812	889	3,713	1,174	1,717	543	4,943	1,563
Ultra Mesa 9C-35D	4,871	1,540	8,944	2,828	5,732	1,813	4,748	1,502
Shell Mesa 7-29	2,246	710	3,361	1,063	1,977	625	1,989	629

Questar conducted noise monitoring at one well pad where completion operations, plug-drilling, and down-rigging occurred during December 2005. Noise from operations was combined with noise from vehicle traffic, wind, and noise from operations on other nearby pads. The study concluded that the highest noise was associated with completion operations; however, well completion also coincided with the highest traffic volume (15 vehicles per hour entering or leaving the pad) and the highest winds during the monitoring period (TRC Mariah Associates, Inc., 2006).

In the Jonah Infill Drilling Project Area, well testing (fracturing and flaring) operations were reported to produce noise levels up to 115 dBA, attenuating to 55 dBA at 3,500 feet (BLM, 2006a). Flaring (one component of completion operations) tended to be the loudest noise event. But, with the use of flowback separators, noise from completion operations was reduced to approximately 64 dBA at the source. Noise levels at the Falcon Compressor Station in the south of the PAPA are about 77 dBA near the compressor station and about 65 dBA about 1.0 mile to the east (BLM, 2006a).

3.13 GEOLOGY AND GEOLOGIC HAZARDS

3.13.1 Development Within the PAPA

The PAPA is located on a northwesterly to southeasterly plunging anticlinal ridge within the Green River Basin Geologic Province. The anticline trends parallel to the Wind River Range in the north of the basin where the basin converges between the Wind River and Teton ranges. The structural basin filled with thousands of feet of continental and marine deposits in Paleozoic and Mesozoic times, and with river and lake deposits during Tertiary time. The anticlinal fold formed as the basin was uplifted in the mid to late Tertiary. Principal near-surface formations in the basin are the lower Tertiary Green River, Wasatch and Fort Union formations. Wasatch strata crop out or subcrop under Pleistocene terrace alluvium over most of the PAPA.

Pleistocene alluvium consists of glacial outwash and till terraces north of the New Fork River. Recent alluvial deposits along the river flood plains are referred to here as valley fill to distinguish them from the terrace deposits. Terrace alluvium covering the Mesa in the north of the PAPA was deposited in a fan at the head of the basin, and is an erosional remnant of more continuous deposits of the Greater Green River Basin through which the Green River subsequently cut down (Bradley, 1964; Love and Christiansen, 1985; Roehler, 1992 and 1993; and Love, et. al., 1993). Eight terrace levels have been identified in this flood plain complex (BLM, 1999a), constructed mainly of well-sorted, rounded cobble gravels. The modern valley fill in intermittent drainages is fine sand and weathered shale, and in major valleys is fluvial and reworked terrace gravels.

In the south of the PAPA, the Green River Formation is represented by outliers of marginal deposits of the Eocene Lake Gosiute, which, to the distant south, has accumulations of thick marlstones, oil shale, and trona.

The Wasatch Formation consists of gray and brown fluvial shales and arkosic sandstone. Elsewhere, Wasatch sandstones form gas reservoirs for hydrocarbons originating deeper in the section; in the PAPA, the sandstones are the principal water supply aquifer. The underlying Fort Union Formation also consists mainly of shales and sandstones, with coal beds.

Deeper strata, particularly the Cretaceous Lance Formation, have yielded oil and gas throughout the Green River Basin. Natural gas is found in several reservoir formations in the geologic section, with significant reserves in structural traps such as the Pinedale Anticline. The Jonah Field to the southwest of the PAPA, on an extension of the anticline, is a major gas producer. These gas reservoirs are "tight sands," have not been commercially producible until recent advances in drilling technology and enhancements, such as hydrofracturing, which opens up communication between the wellbore and the targeted sandstone.

Geologic hazards are not of notable concern in the PAPA. Steep slopes on the flanks of the Mesa would be susceptible to small slides if seismically disturbed, particularly in loose alluvium-colluvium, but no slides or earthflows have been mapped in the area. Earthquake epicenters have been mapped in the immediate vicinity of the PAPA and are presumed due to movement on thrusts deep beneath the anticline. The highest recorded magnitude is III - Modified Mercalli Intensity Scale in 1931 (Case et al., 1995). The USGS estimated that a 4.2 to 4.5 magnitude earthquake might occur somewhere in the Green River Basin every 62 years (BLM, 1999b). A widely reported magnitude 5.1 to 5.3 seismic event that occurred near Rock Springs in 1995 was found to be due to a large roof collapse in a trona mine (Pechman et al., 1995).

A schematic geological cross section of the natural gas resources in the Green River Basin is shown in Figure 3.13-1 (Ultra Resources, Inc., 2005). The Cretaceous Lance Formation is the primary target, particularly along the crest of the faulted anticline, but deeper sandstone strata, such as the Rock Springs Formation of the Mesaverde Group, are also potential targets. The PAPA is mostly to the right (northeast) of the anticline-flanking thrust fault, and the Jonah Field Project Area is to the left (southwest). In this figure, the Wasatch and Fort Union Formations compose the undifferentiated Tertiary strata.

USGS (Crockett et al., 2003), following Montgomery and Robinson (1997) assessed the gas potential (non-coal bed methane) in the PAPA and Jonah Field Project Area for BLM's Reservoir Management Group and made the following determinations with respect to the PAPA:

- "Very High Potential Area – defined as a 1.5-mile wide band lying on the Pinedale Anticline axis including all acres 1 mile east and 0.5 mile west of the anticlinal axis with a northwest and southeast limit. This area would include over 500 additional wells per township (approximately 36 square miles)."
- "High Potential Area – defined as a 3-mile wide band lying on the Pinedale Anticline axis including all acres 2 miles east and 1 mile west of the anticlinal axis with a northwest and southeast limit. This area would include 100 to 500 additional wells per township."

- "Moderate Potential Area – defined as a 5-mile wide band lying on the Pinedale Anticline axis including all acres 3 miles east and 2 miles west of the anticlinal axis with a northwest and southeast limit. This area would include 20 to 100 additional wells."
- "Low Potential Area – includes all other areas in the PAPA and beyond. This area would include fewer than 20 additional wells per township."

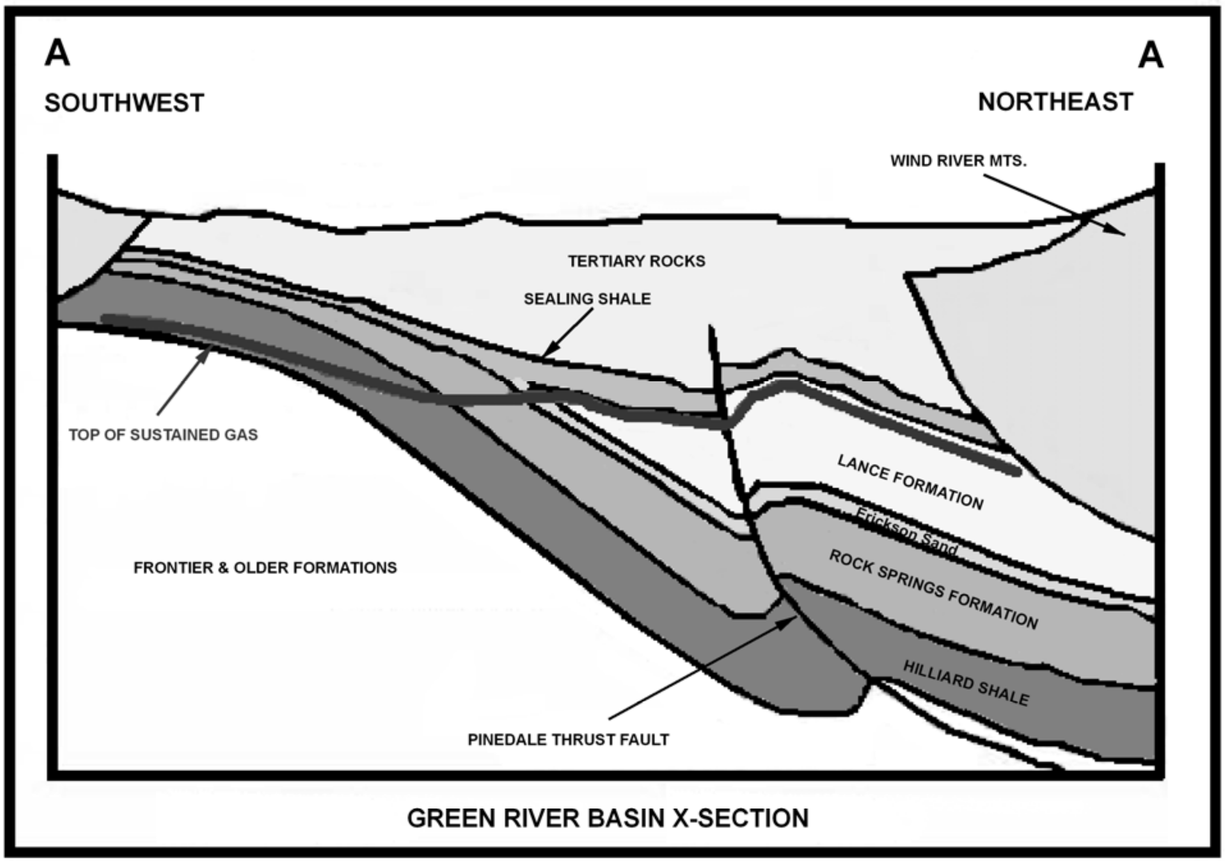


Figure 3.13-1
Geological Cross Section of the Green River Basin and Pinedale Anticline Area

3.13.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments cross mostly flat to gently rolling plains of the Green River Basin. Deposits of three geological formations, from oldest to youngest, the Wasatch Formation (Alkali Creek Member), the Green River Formation (Laney Member), and the Bridger Formation (Bridger A), are crossed by the proposed corridor/pipeline alignments. Overlying these formations along substantial portions of the corridors is a varying thickness of Quaternary (Recent) age alluvial, colluvial, stream terrace gravels, and wind-blown sands. The slopes along the route are rated between 7 and 10 by the Natural Resource Conservation Service (NRCS), indicating slopes that are generally less than 5 percent, with limited areas displaying slopes of 5 to 10 percent (Hamerlinck, 2002).

The proposed BCC and R6 (Segment 1) and PBC pipeline alignments cross deposits of the Wasatch Formation (Alkali Creek Member) exposed on uplands north and south of the New

Fork River. The rocks of the Wasatch Formation consist of locally conglomeratic, brown, green, and gray sandstone interbedded with siltstone, mudstone, and shale.

Just south of the dissected Blue Rim Area, south of the New Fork River, the topography changes from gently rolling to nearly level plateau surfaces underlain by fine-grained oil shale and mudstone of the Laney member of the Green River Formation.

The Laney member dominates the surface geology from just south of the Blue Rim Area to just south of the Green River and underlies the initial portion of the BFGC and R6 Pipeline (Segment 2) alignments. Bluffs of exposed rocks of the Green River Formation surround Fontenelle Reservoir.

Most of the area south of the Green River traversed by the proposed BFGC and R6 Pipeline (Segment 2) alignments and the OPC and Opal Loop III Pipeline alignments is dominated on the surface by the Eocene Bridger Formation (BLM, 1999b). The Bridger is composed of olive-drab and white sandstones, claystones, and conglomerates (Langeson and Spearing, 1988) that erode into rugged badlands with small sand dune and terrace gravel inclusions. Fractured sandstone bedrock can be found approximately 24 to 36 inches below the surface. The windblown sand deposits have been stabilized by vegetation.

Along segments of the proposed corridor/pipeline alignments that cross river bottoms, stream terraces, and on buttes, rocks of the Wasatch, Green River and Bridger formations are overlain by younger unconsolidated sediments of Quaternary age. The sediments include alluvium, colluvium, stream terrace gravels, and wind-blown sands.

Lands crossed by the proposed corridor/pipeline alignments do not show evidence of major landslides (BLM, 1999b). There are no known active faults along the proposed corridor/pipeline alignments (Wyoming State Geological Survey et. al., 2000).

3.14 PALEONTOLOGICAL RESOURCES

3.14.1 Development Within the PAPA

Paleontologic resources include the remains or traces of any prehistoric organism which has been preserved by natural processes in the earth's crust. BLM manages paleontological resources for their scientific, educational, and recreational values in compliance with the Antiquities Act of 1906, in order to protect and preserve representative resource samples in the PAPA. The Probable Fossil Yield Classification (PFYC) system, as adapted by BLM's Regional Paleontologist, serves as a guide for classification of potential paleontological resources (BLM, 2003c). The PFYC is a draft classification system wherein geological units are classified according to the probability of yielding paleontological resources that are of concern to land managers (USFS, 2001). Decisions to restrict areas for resource protection are evaluated on a case-by-case basis for each proposed surface disturbing activity.

Twenty-five recorded localities occur within the PAPA (Winterfeld, 1998). A review of the institutional records by Winterfeld (1998) resulted in identification of 59 fossil localities of importance near the PAPA. An additional 15 localities of importance were identified in a published report on the geology and paleontology of the area (West, 1973).

The Green River and Wasatch formations continue to have high potential for yielding significant paleontological resources within the PAPA. Fossils can be found where formation outcrops exist, and when surface disturbance exposes the formations. In general, the more accessible an area is, the greater the potential for resource discovery. Fossils, as a part of the substratum, are constantly being exposed by erosion (Robinson, 1998).

The Blue Rim Area of the PAPA is especially vulnerable to exposure of paleontological resources because it contains highly erodible Wasatch soils that have little vegetative ground cover. This area was included in MA 7 (Ross Butte/Blue Rim) in the PAPA DEIS (BLM, 1999a). An objective of this MA is to protect the paleontological resources and avoid disturbing the outcrops of the Wasatch. As of December 2005, there were approximately 525 acres of wellfield disturbance within the Blue Rim Area with an estimated disturbance of 65 acres projected in 2006. Several vertebrate fossils, including turtles, crocodilians, and fish, were recorded at paleontological localities found in the Blue Rim Area (Drucker, 2006). Most recently, a fossil mammal, possibly that of an early rodent, was found during road construction to a cellular communications tower site on Ross Butte (Drucker, 2006).

Limited outcrops of the Green River Formation exist in the southeastern portion of the PAPA, near the Jonah Field Project Area. The formation is well known for its abundant fossil specimens, and the lack of documented fossils in the PAPA is most likely because the areas have not been sufficiently studied (BLM, 1999a).

3.14.2 Pipeline Corridors and Gas Sales Pipelines

The exposed bedrock formations underlying the proposed corridor/pipeline alignments include the Wasatch Formation (Alkali Creek Member), Green River Formation (Laney Member), and Bridger Formation (Bridger A and B). These formations, exposed intermittently along the proposed corridor/pipeline alignments, are known to produce scientifically significant fossils, have the highest paleontological potential and meet the BLM’s standards for Paleontology Condition 1 and Probable Fossil Yield Classification 4 and 5 (Hanson, 2006b).

Overlying these formations along portions of corridors crossing river bottoms and some uplands is a varying thickness of Quaternary (Recent) age sediments that are, for the most part, too young to contain fossils. However, one locality in Quaternary sediments along Yellowpoint Ridge has produced prehistoric horse remains of unknown age (Vlcek, 2005).

The Alkali Creek Member of the Wasatch Formation formed in fluvial and flood plain environments in a northwest trending band about 25 miles wide that extended from just east of the Wyoming Thrust Belt to near Pinedale. This deposit underlies the proposed BCC and the R6 Segment 1 and PBC pipelines to just south of the Blue Rim Area. Fossil vertebrates are fairly common in the variegated mudstones. Fossil localities have also been recorded in the member in T. 28-32 N., R.108-112 W. (West, 1969 and 1973).

From just south of the Blue Rim Area, the proposed corridor/pipeline alignments cross exposures of the Laney Member of the Green River Formation to points just south of the Green River. Scientifically significant fossils have been known to occur in the Laney Shale Member of the Green River Formation for more than 150 years (Grande, 1984 and 1989 and Breithaupt 1990). The first discovery of fossil fish was made by a geologist, Dr. John Evans, near Green River, Wyoming. The first of these specimens was sent to Joseph Leidy in Philadelphia and identified as a herring, *Clupea humilus* in 1856. The herring was renamed *Knightia eoceaena* and has subsequently become Wyoming's State fossil.

Since this early discovery, many collections of fossil fishes, other vertebrates, insects and plants have been made from the Green River Formation and the specimens are world renowned for their preservation. Collections of specimens are housed in many major museums around the world and sold in rock shops across the United States. In addition to fish, a wide variety of other fossils, including the remains of amphibians, reptiles, birds, invertebrates and plants are known from the Laney Shale (Bradley, 1964; West, 1969 and 1973; and Grande, 1984). Plant and insect fossils are very common. The most common insect fossil is the mosquito, Culex sp. Other invertebrate fossils known from the Laney Shale include insects, ostracodes, mollusks, and gastropods. Numerous plant fossils occur as well, with the remains of Plantanus sp. (sycamore) and Equisetum (scouring rush), being especially common (MacGinitie, 1969). In places, remains of algal mounds, or stromatolites, occur and may exceed a few feet in height and 15 feet across.

Among vertebrates, the most common fish in the Laney Shale include the herring genera, *Knightia* and *Gosiutichthys*. Other vertebrates, including birds, salamanders, turtles, crocodilians, and mammals, are rarely reported. At least one complete articulated turtle and a two nearly complete crocodilian skeletons are known from the member, as well as some undescribed mammalian skeletons in private collections. The remains of small perching birds, primobucconids, are also known from the Laney Shale, but the most abundant bird remains apparently are the impressions of feathers (Olsen, 1987 and 1992).

From points just south of the Green River, the proposed corridor/pipeline alignments cross exposures of the Bridger Formation. Fossil vertebrates have been collected from the Bridger Formation for more than 135 years (Leidy, 1856) and collections of Bridger specimens are housed at nearly every major paleontological institution in the world. The abundance of fossil vertebrates in the Bridger Formation has been documented along the proposed corridor/pipeline alignments in previous project reports (EVG, 1999, 2001a, 2001b, 2002a, 2002b). Fossil turtles and other reptiles are the most common vertebrate fossil in the Bridger Formation. Most specimens are fragmentary, but complete skeletons of mammals and reptiles (crocodiles) have been collected (McGrew 1971; and McGrew and Feduccia, 1973).

Preconstruction field and open trench field monitoring in the multi-pipeline corridor between the Bird Canyon Compressor Station and the Granger Gas Processing Plant have been conducted on several occasions since 1998 (EVG, 1999, 2001a, 2001b, 2002a, and 2002b). Monitoring has confirmed the presence of vertebrate fossils in the surface lithology along existing pipeline rights-of-way.

3.15 GROUNDWATER RESOURCES

3.15.1 Development Within the PAPA

Groundwater resources are important in the PAPA, with wells supplying domestic and stock water to rural residences in areas far from perennial streams. Groundwater also partially supplies drilling water to the Operators. The area is arid, and the watercourses flowing from the PAPA are generally intermittent.

3.15.1.1 Aquifers

Most domestic and stock wells are less than 200 feet deep, and draw water from alluvium. The most prolific alluvial deposits are an older remnant of outwash gravel on the Mesa, and modern river alluvium. Drilling water supply is drawn from the Wasatch Formation, in wells from 200 to 1,000 feet deep. Water is not used from the underlying Fort Union aquifer because it is deep and of low quality. The gas target zone is the much deeper Lance Formation, which yields low quality water (produced water) in the gas stream.

There are several distinct alluvial systems. The oldest is the terrace outwash gravels, which were deposited as an outwash apron stretching from the Wind River Range, and then cut through by the New Fork River. On the Mesa, it is up to 150 feet thick. Modern river gravels occupying the flood plains of the New Fork and Green rivers are the next youngest aquifer system, and their alluvial water is directly connected to the stream flow. Valley fill alluvium in watercourses draining the PAPA is an accumulation of colluvium, probably silty with low yield. In the south of the PAPA, there is some wind drift sand cover which constitutes a minor alluvial aquifer.

The relationship between these formations and aquifers is shown schematically in Figure 3.15-1. Stock and domestic wells tap shallow groundwater, generally from alluvium. Drilling water supply is obtained by Operators from the Wasatch Formation. Gas is currently produced from the Lance Formation. Natural gas wells and drilling water supply wells are required to be cased and cemented to isolate all water bearing zones above their particular production intervals. Fort Union groundwater is not generally used and is not well characterized (Glover et al., 1998).

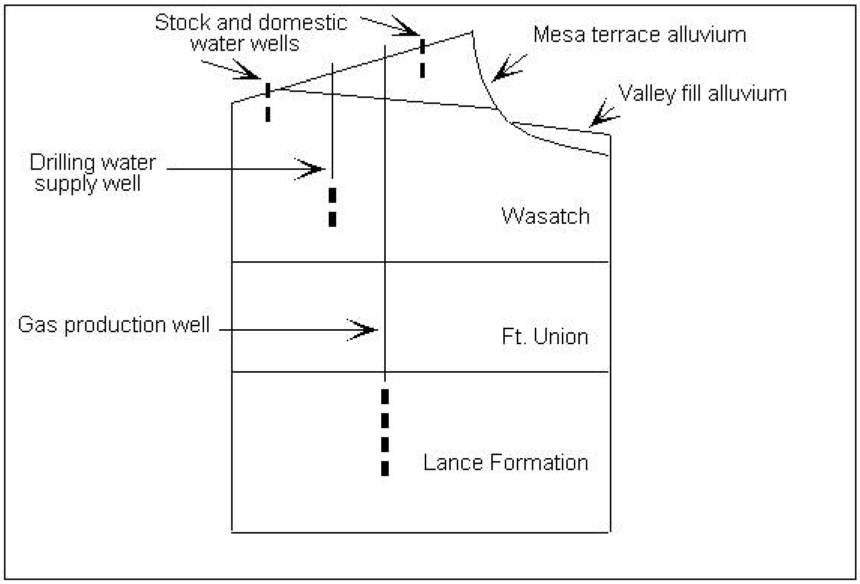


Figure 3.15-1
Relationship Between Major Formations and Aquifers

3.15.1.2 Recharge

Regional potentiometric maps (Glover et al., 1998) for the Wasatch indicate groundwater flow from recharge areas in the north of the Green River Basin southward, to discharge to the Green River in the area of Fontenelle Reservoir. Alluvial aquifers in the PAPA are recharged by local precipitation. The aquifers and discharge to surface water directly or through valley fill alluvium in local drainages.

Annual precipitation is approximately 20 inches in the Wyoming Range (USGS, 1985), and up to 30 inches in the Wind River Range, where the Wasatch is apparently recharged. Because the Wasatch does not crop out against the Wind River Range, infiltration is likely to be less than 1 inch per year in this primary recharge area. Hamerlinck and Arneson (1998) indicate average infiltration rates (groundwater recharge from precipitation) of 0.25 to 0.6 inches per year in the Pinedale area. This range of values gives an estimate of annual recharge over the PAPA of between 4,000 and 10,000 acre-feet/year.

Probably less than half the recharge in the PAPA is to groundwater which is used for stock and domestic supply. Most of the rest of the recharge discharges from alluvium to surface water. A small fraction of the recharge passes through the alluvium into the Wasatch aquifer. The Wasatch in turn appears, from potentiometric data, to discharge some groundwater to the New Fork River in the reach crossing the anticline. The smaller streams south of the New Fork River do not show this connection between surface water and groundwater.

3.15.1.3 Groundwater Quality

The terrace alluvium aquifer has Class I quality water (WDEQ, 2005a), that is, total dissolved solids are less than 500 mg/L, and no constituent concentration exceeds drinking water standards. Predominant ions are calcium and bicarbonate.

The Wasatch contains many discontinuous sands with variable water quality, but here it is treated as one unit because it is treated as one unit for water supply. This complicates discussion of its quality and flow patterns. Wasatch groundwater quality ranges from a sodium bicarbonate type (sodium and bicarbonate are the dominant ions), with TDS less than 500 mg/L, to sodium sulfate-bicarbonate type with TDS up to 1,500 mg/L. Thus, the classification ranges from Class I (TDS less than 500 mg/L, suitable for domestic use) to Class III (suitable for stock use) (WDEQ, 2005a). Sulfate increases with TDS, but because the Wasatch sands are discontinuous and wells are completed in different intervals, there is no evident geographic trend in TDS or any ionic constituent.

Sulfate and TDS data from Wasatch monitoring wells are plotted in Figure 3-15-2, showing concentrations with low-salinity sodium-bicarbonate, and low to moderate salinity sodium-sulfate. The pH of Wasatch groundwater has two modes (frequency peaks, at 8.2 and 9.7), as shown in Figure 3-15-3. The pH does not correlate with TDS, depth, or any other measured parameter, and has been suspected to be due to cement leakage in some of the water supply wells that were sampled. However, others (Chafin and Kimball, 1992) showed regional pH in the Wasatch commonly between 8.5 and 9.5. Wasatch water quality ranges from Class I (drinking water) to Class III (stock water) (WDEQ, 2005a). Any Wasatch water is suitable for drilling, but some with higher salinity may not be appropriate for cementing.

Fort Union sandstones generally contain water with salinity greater than 2,000 mg/L (Glover et al., 1998), which may be adequate in some places for stock and drilling uses.

PAPA valley fill alluvium groundwater is a mix of surface water, Wasatch water, and alluvial water, and the water quality reflects the calcium-sodium bicarbonate composition of the source waters. Currently, there are no monitoring wells in the valley fill alluvium to provide accurate water quality information.

Produced water from the gas-producing interval of the Lance Formation has high salinity and some dissolved organic constituents. Produced water is discussed further in Appendix C and in Section 3.16 - Surface Water.

3.15.1.4 Groundwater Quantity

Historically, groundwater development within the PAPA consisted of stock and domestic wells completed in terrace or river alluvium. Some bedrock wells exist south of the New Fork River where alluvium is thin. Alluvial wells furnish Class I water, with water levels typically less than 50 feet.

Natural gas exploration and production has required supply water for drilling, in the quantity of approximately 15,000 bbl per gas well. Most of this drilling water has been obtained from water supply wells installed in the Wasatch aquifer ranging from 200 to 1,000 feet in depth. Water for drilling is also obtained from recycled produced water. Wyoming State Engineer's Office (2006) water rights database shows approximately 4,000 adjudicated points of use, of which 414 are for industrial use (gas production). Many of these records are duplicates of registered wells because each point of use acquires its own record. Rationalizing this database and others at USGS and WDEQ has been attempted (Dynamac, 2002), but a complete and verified list of wells in the PAPA and their construction and survey details has not been compiled.

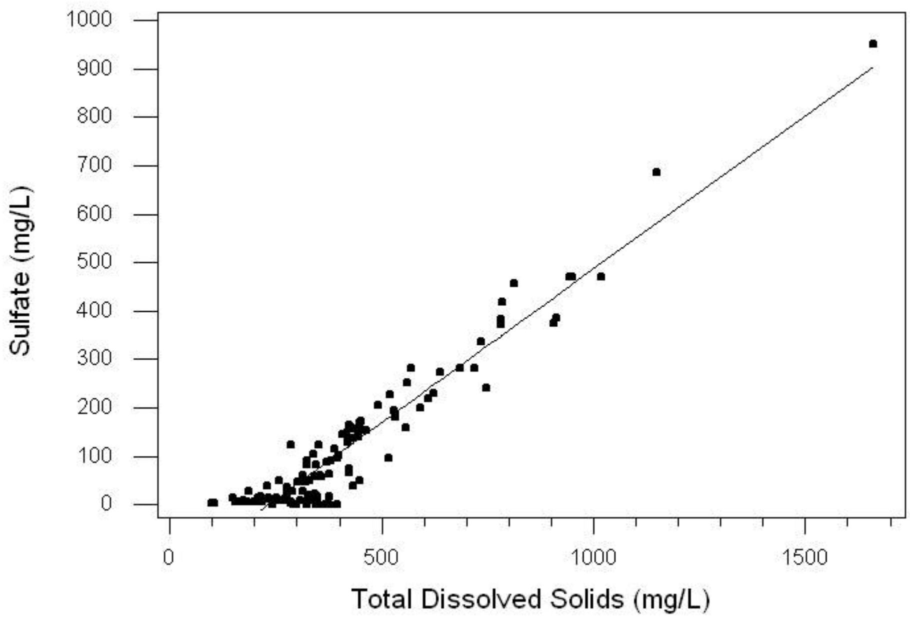


Figure 3.15-2
Relationship of Sulfate Concentrations to Total Dissolved Solids in Wasatch Groundwater

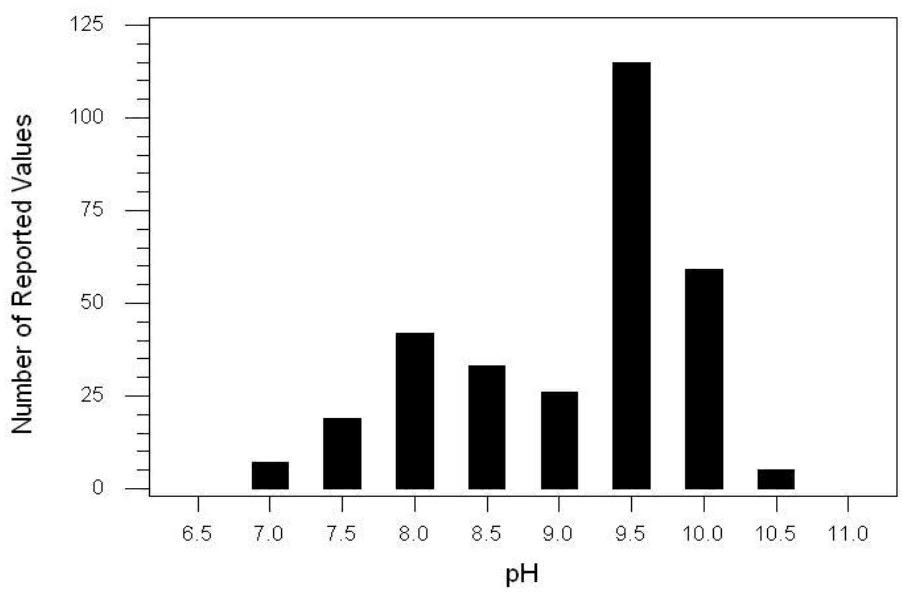


Figure 3.15-3
Distribution of pH in Wasatch Groundwater

Some groundwater is used for dust control. The quantity varies widely between Operators, estimates in 2005 range from 10,000 to 200,000 bbl/day. Use of groundwater for dust control is seasonal and depends on road surfaces in a particular work area, amount of traffic, and the extent to which the Operator uses treated produced water for dust control. Some treated produced water has been used on a trial basis, with reverse osmosis added to the treatment to remove trace metals.

The dominant flow direction in alluvial terrace deposits and Wasatch water-bearing units north of the New Fork River is toward the New Fork River, which cuts across the PAPA. Again, supply wells in the Wasatch average the Wasatch potentiometric level (the elevation at which water stands in a well), and many individual observations do not follow the pattern, but the overall potentiometric gradient (the flow direction) in the Wasatch is to the south as indicated in regional maps (Glover et al., 1998). Where the New Fork River crosses the anticline, potentiometric contours converge on the New Fork elevations, indicating that groundwater is flowing to the river; meaning the river is gaining by groundwater discharge in that reach. Groundwater discharge to stream baseflow north of the New Fork River occurs principally in watercourses via valley fill alluvium. Exposed springs are not common in the PAPA.

South of the New Fork River, where relief is lower, the Wasatch groundwater appears to flow toward the Green River, by-passing ephemeral watercourses draining east and west. There is less infiltration to groundwater, south of the New Fork River, where there is lower precipitation (USGS, 1985) and finer-grained soils.

Depths and water bearing zone thicknesses for drilling supply wells monitored in the PAPA in 2005 are plotted in Figure 3.15-4. Well depths range from 300 to 1,000 feet, confirming they are Wasatch wells. The thickness of the water bearing interval is typically less than 200 feet.

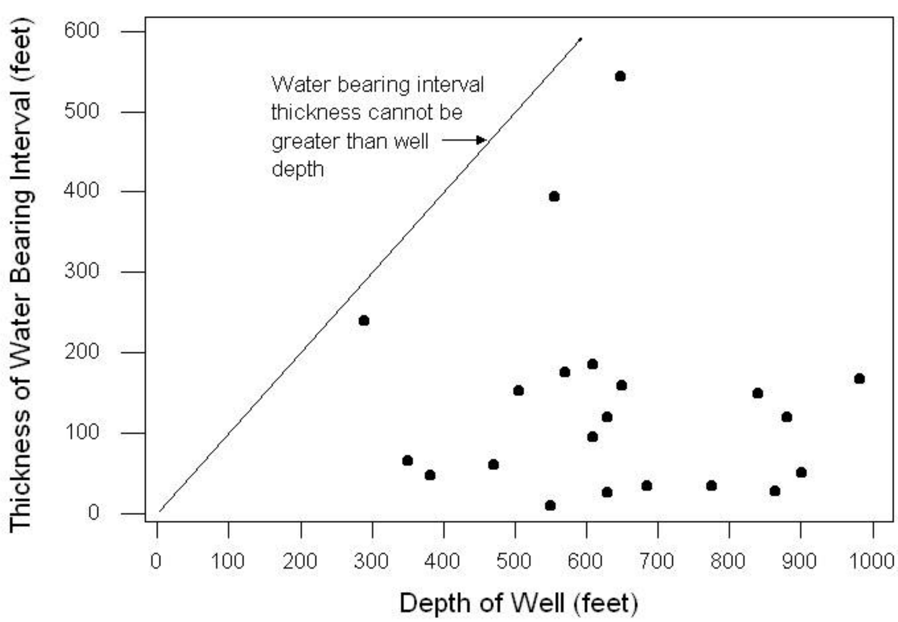


Figure 3.15-4
Data from Drilling Supply Wells in the PAPA

The nature of the local watercourse alluvium is not known, either north or south of the New Fork River, but it is expected to be predominantly accumulated colluvium, fine-grained, and of low yield. These deposits are of interest primarily as conduits for sub-flow of groundwater to surface water.

3.15.1.5 Groundwater Monitoring

Monitoring of groundwater for baseline characterization began following issuance of the PAPA ROD (BLM, 2000b). The PAPA ROD required that "… The Operators would conduct a survey and a complete water analysis (ex. static water level, alkalinity, salinity, benzene, oil, etc.) of all water wells within a 1 mile radius of existing and proposed development, and annually monitor and maintain a complete record of water analysis of all new water supply wells drilled in the PAPA to evaluate the quality of source options in the event some mitigation is required."

Since July 2001, the Sublette County Conservation District (SCCD) has inventoried water wells within 1 mile of existing or proposed natural gas wells within the PAPA. SCCD sampled groundwater from August 23, 2004 through January 6, 2005 on behalf of PAPA Operators on over 230 wells. Many, if not most of these wells, have uncertain open intervals and they are in various sands of the Wasatch Formation. Because these sands are lenticular ancient river channel deposits within low permeability shales, sands cannot readily be correlated between borings and different units are intersected in each well. The Wasatch is therefore characterized by this baseline program as a compound aquifer system with variable chemistry.

In a letter to the Pinedale Field Office Manager dated August 15, 2005, WDEQ expressed concern that there is no consistent construction information for the wells being monitored by SCCD. Without this information, the monitored intervals are not known. BLM is addressing this concern through review of the monitoring program, in consultation with WDEQ.

3.15.2 Pipeline Corridors and Gas Sales Pipelines

Most of the proposed corridor/pipeline alignments cross outcrop and colluvium-covered subcrop of Tertiary-age rocks, Quaternary alluvium in river valleys, and some in eolian sands. Quaternary aquifers are thin and low-yielding except for where they are in direct contact with rivers. Tertiary aquifers consist of lenticular sands of the Wasatch Formation and fractured siltstones of the Green River Formation. The potential for groundwater contamination is low to medium except along the river drainages (Hamerlinck and Arneson, 1998). Groundwater in the Green River Basin is used for agricultural, municipal and domestic, and industrial purposes (States West, 2001).

There are existing water wells near the proposed corridor/pipeline alignments, primarily in the area surrounding Granger and near the Granger Gas Processing Plant (BLM, 2004b). Well yields from the Wasatch aquifer system, the most extensive aquifer system in the Green River Basin, are typically between 20 and 500 gallons per minute. The average well depth in the portion of the Green River Basin within Sweetwater County is 385 feet (Hamerlinck and Arneson, 1998).

Groundwater quality varies by location and by aquifer (Hahn and Jessen, 2001) in the proposed corridor/pipeline alignment. The concentration of TDS exceeds the secondary drinking water standard in over 50 percent of the wells sampled, and sulfate exceeds the secondary drinking water standards in about 33 percent. Although the water quality of these higher TDS and sulfate waters does not necessarily prevent their use, it limits their suitability. The quality of groundwater at several locations is considered poor, and would require extensive treatment to produce suitable drinking water. Hahn and Jessen (2001) reported that there was insufficient data available to assess whether alternative groundwater sources of better quality might be accessible in areas crossed by the proposed corridor/pipeline alignments.

3.16 SURFACE WATER

3.16.1 Development Within the PAPA

The major streams in the PAPA are the Green and New Fork rivers. The New Fork River originates in the Wind River Range north and east of the PAPA, and cuts across the anticline to join the Green River, which originates in the Wyoming and Wind River ranges to the north and northwest. These rivers are fed mostly by snowmelt, with runoff rising from April to peak flow in June. Groundwater feeds baseflow in streams from October through March, in which there is little precipitation except for headwater snowpack accumulation. There are several reservoirs on New Fork tributaries which provide flood control, supply water to irrigation, as well as being recreational and fish and wildlife resources. South of the New Fork River, ephemeral streams drain the PAPA to the Green River in an area of low relief and salty soils.

The Green and New Fork rivers have high quality water above the PAPA, with TDS typically less than 100 mg/L in headwaters. Salinity in the New Fork River actually decreases along the northeast flank of the PAPA due to dilution by very low TDS streams entering from the east. In the Green River and in the New Fork River from Boulder to the Green River, salinity increases downstream due to contributions from irrigation return flow, groundwater discharge, and runoff from salty soils in the lower reaches, but these two rivers are prime sport fishing waters over their entire lengths.

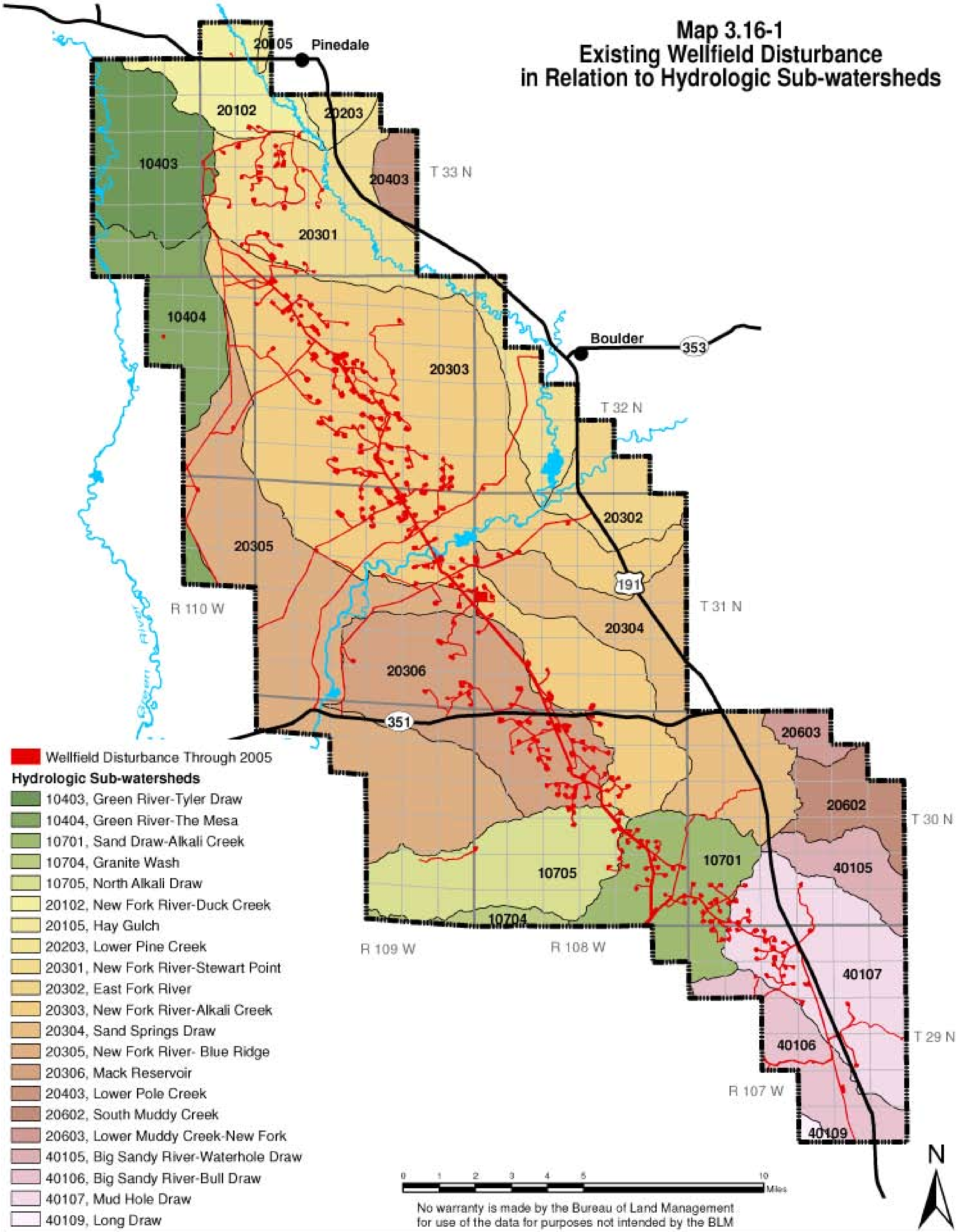
Three other perennial streams passing through the PAPA are Duck Creek, East Fork River, and Pine Creek. These are all tributaries to the New Fork River. However, most of the PAPA is drained by numerous ephemeral streams, each of which collect and drain water from small sub-watersheds within the PAPA. These streams also receive some seepage from groundwater, although this is insufficient to sustain surface flow throughout the year. For most, if not all ephemeral streams in the PAPA, runoff peaks during snowmelt. Thunderstorms can also generate sporadic stream flow.

There are 21 sub-watersheds (at Hydrologic Unit Code level 6 in USGS classification) draining the PAPA (see Map 3.16-1), although 10 of these are only on the margins of the PAPA. The largest sub-watershed complex, flowing to the New Fork River in the eastern portion of the PAPA, includes drainage from Duck Creek, Sand Springs Draw, and several unnamed draws and ditches. On the west side of the PAPA, Tyler Draw, and a few other unnamed draws in the northwest portion of the PAPA are intermittent. North Alkali Draw and Sand Draw drain to Alkali Creek, which is tributary to the Green River in the southwest portion of the PAPA. The Green River is not present in the southwest portion of the PAPA. In the southeast portion of the PAPA, Water Hole Draw, Mud Hole Draw, Bull Draw, and other small drainages discharge to the Big Sandy River

3.16.1.1 Colorado River Basin Salinity Considerations

The PAPA is in the upper Colorado River Basin, for which special regulation has been enacted to control and mitigate river water salinity, to fulfill treaty obligations with Mexico. Congress enacted the Colorado River Basin Salinity Control Act, Public Law 93-320 1974 Title II – Water Quality Program for Salinity Control, and the 1984 Amendment, Public Law 98-569, directed by BLM to implement a comprehensive program to minimize salt loading in the Colorado River Basin. BLM coordinates salinity control activities with the Colorado River Basin Salinity Control Forum (CRBSCF), the BOR, and the NRCS. BLM, BOR, and NRCS receive Congressional funding for salinity control. Other federal agencies that have a stake and participate in the CRBSCF Work Group meetings include EPA, FWS, and the USGS.

The CRBSCF identified rapidly expanding energy development in the Upper Colorado River Basin as a high-priority issue because it has the potential of an adverse effect on achieving the


Map 3.16-1
Existing Wellfield Disturbance
in Relation to Hydrologic Sub-watersheds
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
20105
20102
20203
10403
20403
20301
10404
20303
20302
20305
20304
20306
20603
20602
10705
10701
40105
10704
40107
40106
40109
Wellfield Disturbance Through 2005
Hydrologic Sub-watersheds
10403, Green River-Tyler Draw
10404, Green River-The Mesa
10701, Sand Draw-Alkali Creek
10704, Granite Wash
10705, North Alkali Draw
20102, New Fork River-Duck Creek
20105, Hay Gulch
20203, Lower Pine Creek
20301, New Fork River-Stewart Point
20302, East Fork River
20303, New Fork River-Alkali Creek
20304, Sand Springs Draw
20305, New Fork River- Blue Ridge
20306, Mack Reservoir
20403, Lower Pole Creek
20602, South Muddy Creek
20603, Lower Muddy Creek-New Fork
40105, Big Sandy River-Waterhole Draw
40106, Big Sandy River-Bull Draw
40107, Mud Hole Draw
40109, Long Draw
0 1 2 3 4 5 10
Miles
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for use of the data for purposes not intended by the BLM
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adopted numeric salinity standards, which would violate the water-quality salinity-based standards and endanger downstream water users, and potentially affect the U.S. agreement with Mexico.

3.16.1.2 Surface Water Quality

All of the Green River, upstream of the confluence with the New Fork River is designated Class 1 water under WDEQ Surface Water Standards (WDEQ, 2001), meaning that they are “outstanding” waters that may not be degraded. The waters of the New Fork River and tributaries are Class 2AB, meaning that they meet the same standards as Class 1, at least seasonally, but are protected by use determination rather than value determination under WDEQ rules.

The SCCD monitors water in the streams of the New Fork basin quarterly. Details of the monitoring program can be found in the Sampling and Analysis Plan (SCCD and PAWG, 2005). The samples are collected in March (estimated spring runoff peak), July (peak flow), and the first week in September and November. Biological samples are taken in the latter two periods.

Annual reports that include monitoring analysis data, compilation of spill reports from the PAPA, and incremental surface water sampling are prepared and provided by the SCCD to the PAWG Water Resources Task Group and BLM by December 1 of each year. They are reviewed with the public during the annual AEM review, as required by the PAPA ROD (BLM, 2000b).

A report by EcoAnalysts, Inc. (2005) concluded that there has been no discernible change in water chemistry, salt load, sediment load, or invertebrate biology indices in 5 years up to that time. Suspended sediment load (field measurement of turbidity and lab measurement of total suspended solids) is not statistically higher just above the confluence with the Green River than at upstream stations. EcoAnalysts inspected the bed for indications of increase in fine bed load which would impair aquatic life.

There are three monitoring points relating directly to the PAPA. They are on the New Fork River above the PAPA (NF4) and one each upstream (NF30) and downstream (NF19) of the location where the New Fork River crosses the anticline. Data show that salinity (TDS) decreases down the northwest flank of the PAPA (from NF4 to NF30), then increases again across the anticline to NF19. The decrease is due to dilution by tributaries coming off the Wind River Range (such as Pole and Boulder creeks). The increase is due to Alkali Creek and other drainages entering the anticline section. TDS in the New Fork River above Pinedale (NF4) seasonally exceeds 500 mg/L. It is lowest in high water, when more water comes directly from snowmelt, and highest in low flow periods when groundwater seepage sustains baseflow. New Fork River water has predominantly calcium and bicarbonate ions, and is approximately pH neutral (headwater streams average pH 8).

Total suspended solids (TSS), measured at the same points, is often used as an index of increase or decrease of total sediment (no simple method exists for measuring total sediment load, which has suspended and bed load components). TSS is generally less than 10 mg/L in all waters of the New Fork catchment, but variable in the spring, when rain showers can cause it to rise. Many reports are given over 20 mg/L in spring. Highest TSS values in the monitoring record are from the New Fork River near the Green confluence, below Alkali Creek. SCCD does not monitor water quality in the Green River, but USGS (1985) indicated suspended solids averaged 23 mg/L in the upper Green River above the PAPA.

EcoAnalysts (2005) has surveyed invertebrate life annually from the year 2000 at SCCD’s monitoring points in the New Fork catchment to assess stream health based on aquatic insects (mayflies, stoneflies and caddis), which are thought to be sensitive to disturbance. Alternatively, abundance of nematodes, spiders and mites often indicate a stream is stressed. Samples taken at five sites within the New Fork catchment suggest stream health ranges from fair to very good, although, many more samples would be needed to confirm that evaluation.

3.16.1.3 Surface Water Quantity

The USGS maintains river gauging stations on the Green River near Daniel, north of the PAPA, to downstream of Fontenelle Reservoir, and in the New Fork River near the confluence with the Green River. The annual average flow rates (in cubic feet per second, or cfs) at these stations over the period of record are summarized in Table 3.16-1, below. The main tributaries to the Green River between the two gauges are the New Fork River, and Cottonwood, Big Piney, La Barge and Fontenelle creeks.

Table 3.16-1
Average Annual Flow Rates from Gauging Stations Near the PAPA

Gauge location	USGS gauge number	Period of record	Min annual average flow (cfs)	Mean annual average flow (cfs)	Max annual average flow (cfs)
Green River, Warren Bridge, near Daniel	09188500	1932-2005	295	500	768
Green River, below Fontenelle Reservoir	09211200	1964 - 2005	690	1600	3060
New Fork River near confluence with Green River	09205000	1954 - 2005	313	720	1109

There are approximately 377 adjudicated water rights on the New Fork River between Pinedale and Boulder, and another 270 between Boulder and the Green River (Wyoming State Engineer's Office, 2006). There are 54 adjudicated water rights on the Green River at the north end of the PAPA (T. 33 N., R. 110 W). These points of diversion are predominantly for irrigation. The appropriated flows total 13,000 acre-feet/yr, which is equivalent to 18 cubic feet per second (cfs).

3.16.1.4 Wellfield Development Effects

The sub-watersheds recognized by USGS (Map 3.16-1) are listed in Table 3.16-2 along with total surface area of the basins in the PAPA, and areas of surface disturbance by wellfield development as of December 2005 and that proposed by the Operators for 2006. Most surface disturbance has occurred within the Anticline Crest.

The Sand Draw-Alkali Creek and Mack Reservoir sub-watersheds have the most disturbance in the PAPA in proportion to their total areas. Over 5 percent of each basin in the PAPA has been disturbed as of December 2005. Other basins with relatively high surface disturbance by wellfield development include the New Fork River-Alkali Creek basin (4.2 percent); Mud Hole Draw basin (2.7 percent); and the New Fork River-Stewart Point basin (2.1 percent). In 2006, the Operators are proposing to disturb an additional 381 acres. Most disturbance would be within the New Fork River-Alkali Creek sub-watershed and Mack Reservoir sub-watershed, both of which drain to the New Fork River (Table 3.16-2).

3.16.1.5 Watershed Modeling

In August 2006, HydroGeo, Inc. modeled erosion and sediment loading of the current condition. The Technical Report - *Erosion Modeling, Transport Modeling, and Salt Loading, Pinedale Anticline Project, Sublette County Wyoming* is provided in Appendix J. Salt concentrations in stream water are not explicitly modeled, but increases in concentration are proportional to the area of soil disturbance. Two USDA models, SWAT and KINEROS2, were used to model impacts in 15 sub-watersheds. The report concludes that there is currently negligible sediment

Table 3.16-2
Estimated Existing Surface Disturbance in Relation to Hydrologic Sub-watersheds in the PAPA

Sub-Watershed (HUC 6)	Sub-Basin	Hydrologic Unit Code	Total Surface Area in Basin (acres)	Surface Area of Basin in the PAPA (acres)	Percent of Basin in the PAPA	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance in Basin	Percentage Disturbance in the PAPA
Big Sandy River-Bull Draw	Big Sandy River	140401040106	19,768	5,761	29.1	74.2	0.0	74.2	0.4	1.3
Big Sandy River - Long Draw	Big Sandy River	140401040109	18,529	316	1.7	0.0	0.0	0.0	0.0	0.0
Big Sandy River-Waterhole Draw	Big Sandy River	140401040105	23,876	3,349	14.0	1.5	0.0	1.5	0.0	0.0
Mud Hole Draw	Big Sandy River	140401040107	19,619	12,923	65.9	341.4	2.9	344.3	1.8	2.7
East Fork River	New Fork River	140401020302	25,005	4,885	19.5	12.0	0.0	12.0	0.0	0.2
Hay Gulch	New Fork River	140401020105	14,668	245	1.7	3.9	0.0	3.9	0.0	1.6
Lower Muddy Creek-New Fork	New Fork River	140401020603	34,520	1,492	4.3	0.0	0.0	0.0	0.0	0.0
Lower Pine Creek	New Fork River	140401020203	25,749	1,276	5.0	3.7	0.0	3.7	0.0	0.3
Lower Pole Creek	New Fork River	140401020403	20,119	1,757	8.7	0.9	0.0	0.9	0.0	0.1
Mack Reservoir	New Fork River	140401020306	15,353	15,353	100.0	771.3	79.0	850.3	5.5	5.5
New Fork River-Alkali Creek	New Fork River	140401020303	49,532	49,522	100.0	2,101.0	252.7	2353.7	4.8	4.8
New Fork River- Blue Ridge	New Fork River	140401020305	39,853	24,909	62.5	216.5	12.3	228.8	0.6	0.9
New Fork River-Duck Creek	New Fork River	140401020102	37,229	5,521	14.8	83.7	8.7	92.4	0.2	1.7
New Fork River-Stewart Point	New Fork River	140401020301	32,670	17,216	52.7	352.9	9.0	361.9	1.1	2.1
Sand Springs Draw	New Fork River	140401020304	19,073	13,207	69.2	77.6	3.7	81.3	0.4	0.6
South Muddy Creek	New Fork River	140401020602	33,923	4,121	12.1	0.0	0.0	0.0	0.0	0.0
Granite Wash	Upper Green River	140401010704	12,218	1,091	8.9	0.0	0.0	0.0	0.0	0.0
Green River-The Mesa	Upper Green River	140401010404	41,713	7,293	17.5	10.1	0.0	10.1	0.0	0.1
Green River-Tyler Draw	Upper Green River	140401010403	34,761	8,834	25.4	21.7	0.0	21.7	0.1	0.2
North Alkali Draw	Upper Green River	140401010705	15,918	9,959	62.6	116.1	0.4	116.5	0.7	1.2
Sand Draw-Alkali Creek	Upper Green River	140401010701	22,941	9,004	39.2	490.0	12.2	502.2	2.2	5.6
Total				**198,034**		**4,678.5**	**380.9**	**5,059.4**		

transport off low slopes in the PAPA, and up to 0.04 metric tons annually per hectare (35 lb/acre/yr) off the steepest slopes. An average of 800 metric tons of sediment is mobilized each year in the PAPA under current conditions, according to the model. Much of the sediment mobilization occurs at low storm frequencies, but sediment largely remains within the lower basins until larger storms move it out of the basins. Some of the Operators are conducting first flush monitoring on some of the streams draining from the PAPA. For first flush monitoring, storm water samples are collected the first occasion a new pad generates runoff.

Modeling indicates that current disturbances do not contribute significantly more sediment transport than would the pristine condition with no anthropogenic disturbance, except in the Mack Reservoir, Mud Hole Draw, New Fork-Alkali Creek, New Fork-Stewart Point and North Alkali Draw. Similarly salt yield off the PAPA, through leaching of dissolved solids in soils, has probably not significantly increased due to gas development to date, except in those same sub-watersheds.

3.16.1.6 Produced Water

Produced water from the Lance Formation is suitable only for industrial use, due to elevated TDS, sulfate and hydrocarbons. Some of it is treated and re-used or discharged, and some is disposed in off-site, deep injection wells. Some treated water (with additional reverse osmosis) has been used on a trial basis for dust control.

There is currently one water treatment facility handling PAPA produced water, the Anticline Disposal Facility. Produced water is either piped or trucked to the Anticline Disposal Facility, depending on the Operator. Between 40 and 60 percent of water used in well completions (fracturing) is produced water with minimal or no treatment. The balance of the water used for completions is more extensively treated water or Wasatch groundwater. Approximately 25,000 to 40,000 barrels of water are used in a single well completion, of which about half flows back immediately and is recaptured. In summer, Operators use evaporative sprinklers in the reserve pits to reduce the amount of water to be disposed. One method of disposal is in deep injection wells at Big Piney. Anticline Disposal has a discharge permit (WY 0054224, May 2006) for up to 630,000 gpd (approximately 1 cfs) treated water, meeting standards for pH, chloride, radium, and TDS (500 mg/L is necessary to qualify as a clean water discharge under the Colorado River Salinity Forum). Anticline Disposal plans to begin discharge of treated produced water in 2007. Discharged water must pass toxicity testing, and an addendum to the permit requires toxicity testing on trout fingerlings, as well as the typical water flea and minnow tests. The discharge point is on the New Fork River, in Section 11, T. 31 N., R. 109 W.

3.16.1.7 Treated Sewage Water

Stallion Services treats sewage from several facilities in the PAPA by biotreatment and filtration. The Hydro-Action Portable Sewage Facility has a discharge permit (05-070, March 05), valid for all counties in Wyoming, to discharge treated “gray water” by sprinkler, up to 4 inches per week. The limitation is intended to prevent water from infiltrating to groundwater. Discharge is purported to meet drinking water standards.

3.16.1.8 Surface Water Withdrawals

Operators may use river water to hydrostatically test new pipeline segments. Withdrawals are made under a S.W. 1 Temporary Permit to Appropriate Surface Water, issued by the Wyoming State Engineers Office (SEO). There must provisions for protection of fish at the pump intake. Hydrostatic test water is discharged to the surface following testing, making sure that water does not directly enter a flowing stream. Discharge is via a dissipating nozzle and dikes, and is supervised to prevent channeling or sheet-wash erosion. Discharge requires a Temporary Discharge Permit issued by SEO under the Federal Water Pollution Control Act (1972, amended in 1977 and since known as the Clean Water Act) and the Wyoming Environmental Quality Act, 1973, amended 1977.

3.16.2 Pipeline Corridors and Gas Sales Pipeline

The proposed corridor/pipeline alignments would cross three perennial streams; the New Fork River, the Green River and the Blacks Fork River. The BCC, the R6 Pipeline and the PBC Pipeline would cross the New Fork River, which has been designated as Class 2AB by WDEQ (2001). Class 2AB waters are protected for drinking water, game and non-game fish, fish consumption, other aquatic life, recreation, wildlife, agriculture, industry, and scenic value.

The BFGC and the R6 Pipeline (segment 2) would cross the Green River below Fontenelle Reservoir. The OPC and the Opal Loop III Pipeline would cross the Green River farther west. The Green River has been designated as Class 2AB at these locations (WDEQ, 2001). The OPC and the Opal Loop III Pipeline cross the Blacks Fork River, which has been designated as Class 2AB by WDEQ (2001).

None of the river segments crossed by the proposed corridor/pipeline alignments are included on Wyoming's Section 303(d) 2006 list of impaired waters, with the exception of the Blacks Fork River. The proposed BFGC and R6 Pipeline (Segment 2) cross the Blacks Fork River in Section 28, T. 19 N., R. 111 W. The listed stream segment of the Blacks Fork River is approximately 2.5 miles downstream of the corridor/pipeline crossing at the confluence with the Hams Fork River in Section 32, T. 19 N., R. 111 W. This downstream segment of the Blacks Fork River is listed as impaired due to high levels of fecal coliform bacteria.

Other surface water resources near the proposed corridor/pipeline alignments include intermittent, ephemeral, and perennial streams; livestock ponds, seeps; springs; and flood plains of the New Fork, Green, and Blacks Fork rivers (BLM, 1999b). Stream channel stability varies from fair to poor.

3.17 SOIL RESOURCES

3.17.1 Development Within the PAPA

In the PAPA DEIS (BLM, 1999a), soils coinciding with the PAPA were classified into four broad groups, based primarily on differences in geologic origin (i.e., parent material and topographic or geomorphic position). The groups include: 1) terrace soils; 2) soils on pediment, alluvial fans and low terraces; 3) upland soils; and 4) alluvial soils on flood plains. No prime farmlands exist within the PAPA. Of particular concern in the PAPA DEIS were soils with characteristics that are considered sensitive to surface disturbance. The characteristics are included below:

- Group 1 - Terrace Soils. This soil group has few limiting or sensitive characteristics. The reclamation potential of this soil group is high because sufficient quality topsoil is typically present. The engineering properties of this soil group for road and well pad development are high because of the high content of coarse fragments in the subsoils. The coarse fragments increase the soil's strength and reduce or eliminate the need to haul in suitable base materials for construction purposes.

- Group 2 - Pediment, Alluvial Fans, and Low Terrace Soils. Most of these soils are characterized as non-sensitive with moderate to high reclamation potentials. The sensitive soils within group 2 include steep soils on escarpments which are either exposed bedrock (Wasatch Formation) or with shallow depth to bedrock. Such soils have a high runoff rate and erosion potential. The high runoff rate limits the effective moisture these soils receive and their shallow depth limits their water holding capacity. This causes these steep sensitive soils to be droughty which further reduces their reclamation potential.

- Group 3 - Flood Plain and Wetland Soils. Sensitive soil characteristics within this soil group include areas that are subject to flooding and soils with high water tables. This soil group has a high reclamation potential. Soils along the flood plains of the intermittent drainages in the southern end of the PAPA (e.g., Alkali Creek, North Alkali Draw, and Sand Springs Draw) are typically saline and can be sodic. Sodic soils are sensitive because of their potential to cause water quality impacts if disturbed. Eroded sediments from these soils could be transported to perennial waters. Additionally, the salinity and sodicity of these soils reduces their reclamation potential.
- Group 4 - Upland Soils. Upland soils have the greatest surface area in the PAPA. Sensitive soils within this group include steep, shallow soils or areas of exposed bedrock (Wasatch Formation) along Blue Rim. These soils have a high runoff rate and erosion potential. The high runoff rate limits the effective moisture these soils receive and their shallow depth limits their water holding capacity. This causes them to be droughty, which severely limits their reclamation potential. Badland soils are included in this sensitive soil group. Badland soils are unique landform features composed of raw exposed slopes of shale and soft sandstone, siltstone, and marlstone.

Sensitive soils (including those with slope of 15 percent or greater) in the PAPA comprise the Sensitive Soils SRMZ. The SRMZ also encompasses the Blue Rim Area of the southern PAPA (Map 3-17-1). NRCS is currently conducting a third order soil survey in the southeastern portion of the PAPA and in adjacent lands in the Jonah Field Project Area. To the extent it was available; these data were used for watershed modeling.

As of December 2005, approximately 241 acres of soils with slopes over 15 percent and 525 acres of the Blue Rim soils were disturbed as a result of natural gas development (Table 3.17-1). Most surface disturbance to sensitive soils has been within the Blue Rim Area, primarily because the Anticline Crest passes through the eastern end of Blue Rim where the most intense natural gas development has occurred (Map 3-17-1). In 2006, the Operators are projecting an additional 26 acres of disturbance in soils with slopes over 15 percent, and approximately 65 acres are likely to be within sensitive soils of the Blue Rim Area (Table 3.17-1). Within the combined area that comprises the Sensitive Soils SRMZ, 707 acres had been disturbed in 2005 and an additional 80 acres of disturbance is projected for 2006.

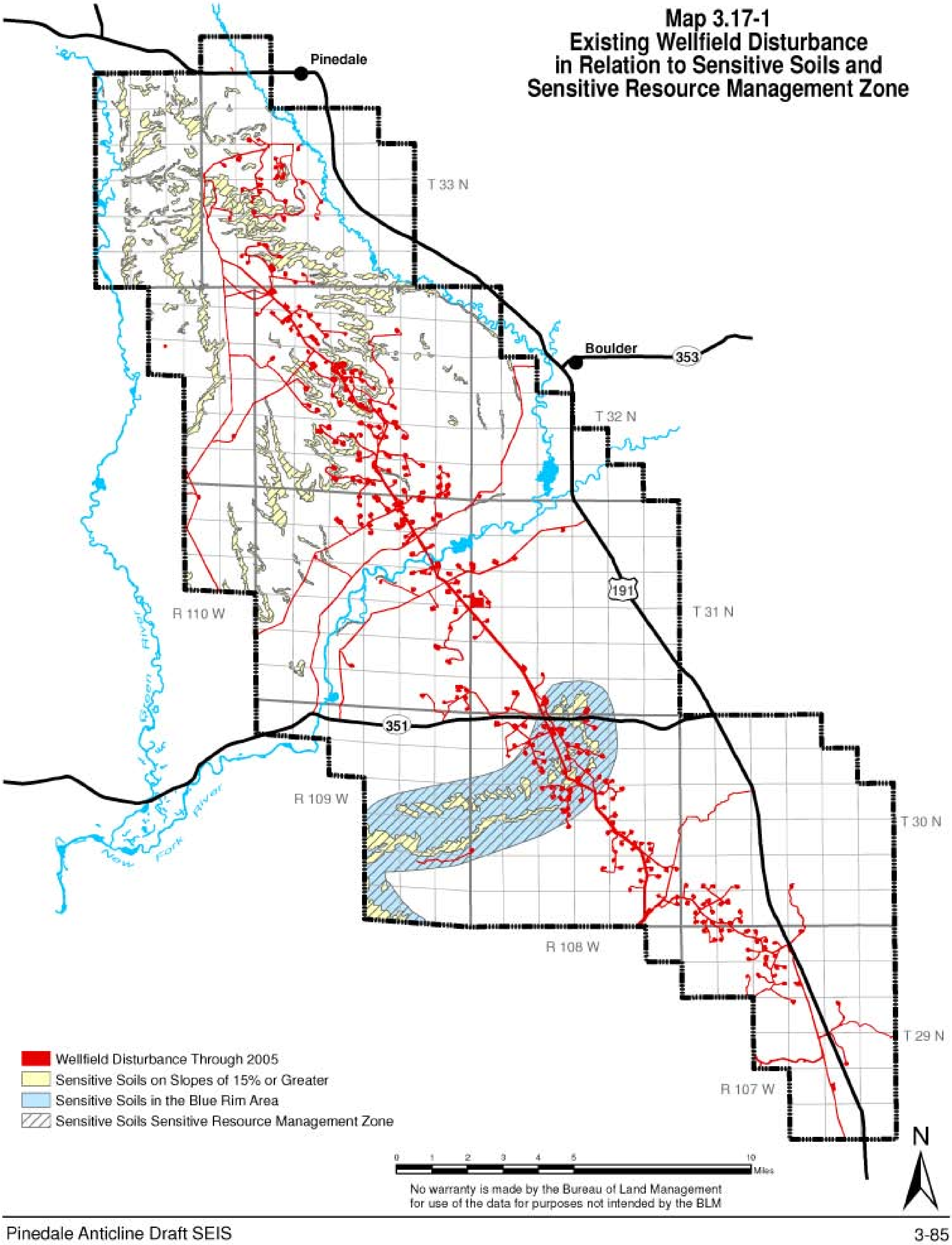
Table 3.17-1
Estimated Existing Wellfield Disturbance in Relation to Sensitive Soils in the PAPA

Sensitive Soils Category	Surface Area (acres) in the PAPA	Surface Disturbance through December 2005	Estimated Additional Surface Disturbance in 2006 [3]	Estimated Total Existing Surface Disturbance	Percentage Disturbance
Blue Rim Area Sensitive Soils	12,925	525.1	64.8	589.9	4.6
Sensitive Soils on slopes ≥ 15%	11,044	240.8	26.1	266.9	2.4
Sensitive Soils SRMZ	21,645	706.5	80.4	786.9	3.6

[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

3.17.2 Pipeline Corridors and Gas Sales Pipelines

From north to south along the proposed corridor/pipeline alignments, the Wasatch Formation, the Laney member of the Green River Formation, and the Bridger Formation dominate the surface rock and are the principal parent materials for soils. Slopes range from nearly level to steeply sloping.


Map 3.17-1
Existing Wellfield Disturbance
in Relation to Sensitive Soils and
Sensitive Resource Management Zone
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Sensitive Soils on Slopes of 15% or Greater
Sensitive Soils in the Blue Rim Area
Sensitive Soils Sensitive Resource Management Zone
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Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
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Soil development in upland areas with high clay-content parent materials resulted in a complex of aridic soils, or Aridisols. The majority of the upland soils crossed by the proposed corridor/pipeline alignments range from very shallow to mostly moderately deep, to deep, forming on rolling upland plains dissected by rock ravines, short escarpments, and draws (BLM, 1997 and 1999b).

The proposed corridor/pipeline alignments would cross sensitive upland soils including soils of the Blue Rim Area, which are shallow soils occupying steeper slopes and areas of rock outcrop. These soils typically have high water runoff rates and are subject to accelerated rates of soil erosion, especially when disturbed. The high runoff rates limit the effective moisture received by these soils, and their mostly shallow depth limits their water holding capacity, causing them to be droughty limiting their reclamation potential.

Less sensitive upland soils include shallow to moderately deep to deep soils that occupy less steep topography. These less sensitive soils are more dominant in extent along the proposed corridor/pipeline alignment, but the shallow soil depths may still limit successful reclamation should recent drought conditions continue in the Green River Basin of Wyoming.

Bottomlands associated with drainages crossed by the proposed corridor/pipeline alignments are flood plains, terraces, and tributary alluvial fans of the perennial New Fork, Green, and Blacks Fork rivers, and several intermittent drainages. The bottomland soils of these drainages form in mostly alluvial deposits, vary in texture, are deep, and are subject to flooding. These soils typically have a high reclamation potential if they are not saline or sodic. These soils can also be susceptible to gully erosion when disturbed.

Soils along the flood plains of the intermittent drainages are likely to be saline and can be sodic, containing high concentrations of sodium in proportion to concentrations of calcium and magnesium in the soil (BLM, 1999b). These soils are sensitive because of their potential to cause water quality impacts, if disturbed, and potential sedimentation of downstream perennial streams. The elevated salinity and possible sodicity of these soils reduces their reclamation potential (BLM, 1999b).

3.18 VEGETATION RESOURCES

3.18.1 Development Within the PAPA

In the PAPA DEIS (BLM, 1999a), BLM described nine vegetation types (excluding human settlements) in the PAPA. Some types were composites of two sub-types, for example high density and low density Wyoming big sagebrush were combined as sagebrush steppe vegetation. Shrub-dominated and forest-dominated riparian vegetation were combined as riparian forest and shrub. Vegetation in the PAPA was mapped during preparation of the PAPA DEIS and the vegetation map is available through the Wyoming Geographic Information Science Center at the University of Wyoming (Map 3.18-1).

Most wellfield disturbance has been within the two sub-types of Wyoming big sagebrush (sagebrush steppe), which cover 147,165 acres of the PAPA. As of December 2005, wellfield activities have resulted in more than 3,500 acres of disturbance to sagebrush, approximately 2.4 percent of all sagebrush-dominated vegetation in the PAPA. A large portion of mixed grasslands (371 acres or 3.1 percent) has also been disturbed (Table 3.18-1).

Surface disturbance in 2006 would likewise mostly affect big sagebrush steppe vegetation, because 270 acres of the approximate 381 acres is projected to be disturbed within that vegetation category (Table 3.18-1).

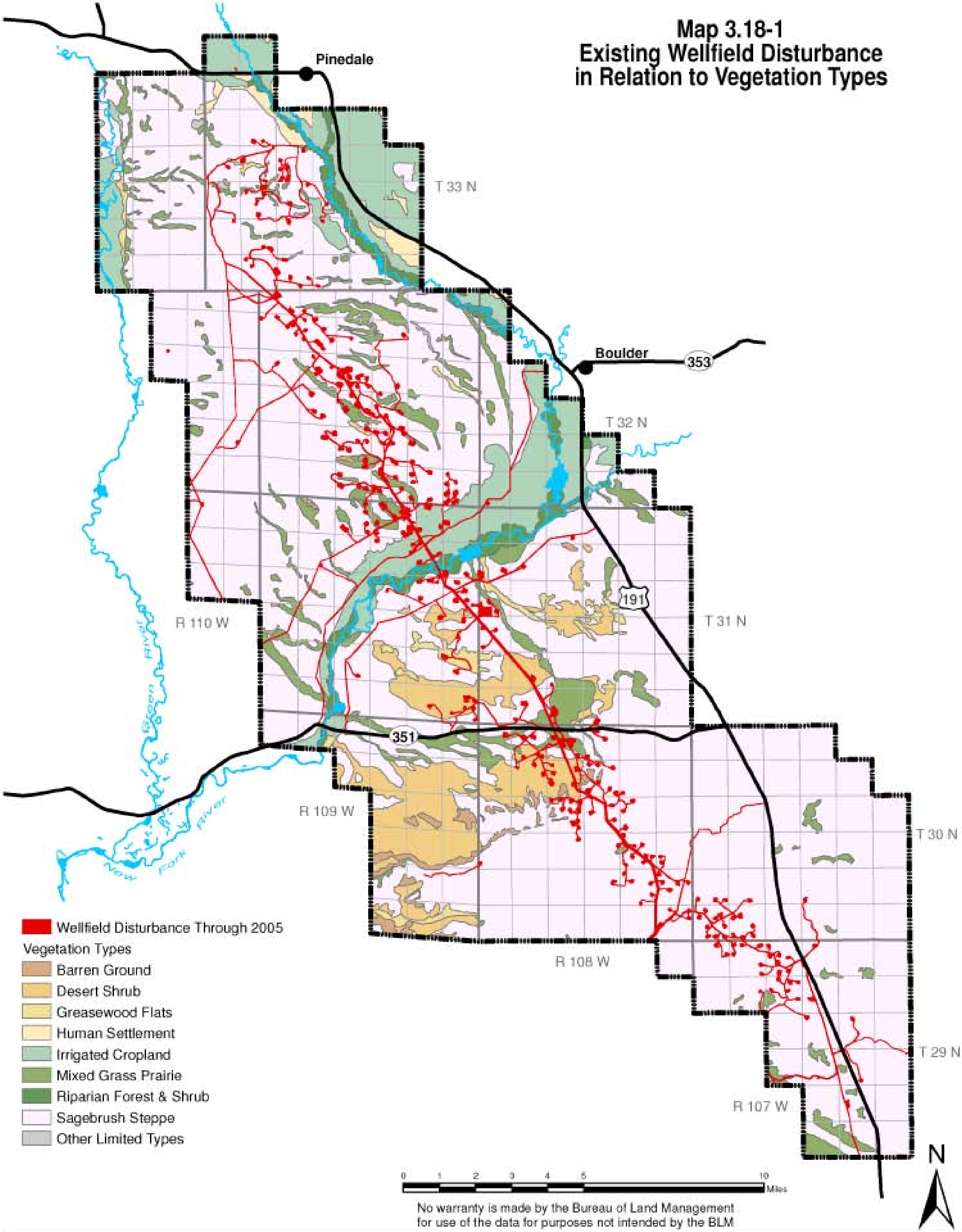

Map 3.18-1
Existing Wellfield Disturbance
in Relation to Vegetation Types
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Vegetation Types
Barren Ground
Desert Shrub
Greasewood Flats
Human Settlement
Irrigated Cropland
Mixed Grass Prairie
Riparian Forest & Shrub
Sagebrush Steppe
Other Limited Types
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Table 3.18-1
Estimated Existing Wellfield Disturbance to Vegetation Types in the PAPA

Vegetation Category	Surface Area) in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Sagebrush steppe	147,164	3,594.0	270.1	3,864.1	2.6
Mixed grass prairie	11,815	371.3	37.8	409.1	3.5
Greasewood flats	1,936	40.5	6.4	46.9	2.4
Desert shrub	11,560	266.3	20.2	286.5	2.5
Riparian forest and shrub	4,348	54.4	16.0	70.4	1.6
Other limited types	324	3.6	0.0	3.6	1.1
Barren ground	1,702	40.9	4.9	45.8	2.7
Irrigated cropland	17,677	285.4	25.5	310.9	1.8
Human settlement	1,508	22.1	0.00	22.1	1.5
Total	**198,034**	**4678.5**	**380.9**	**5,059.4**	**2.6**

Growth, or production, of sagebrush on the Mesa has been evaluated by WGFD since 2004 (Scribner, 2006). Production, measured as average length of sagebrush leaders was greatest (1.25 inches) in 2004 following a winter with average snowfall and above average precipitation for the water year (see Table 3.3-1 and Appendix K, Wildlife Technical Report). Sagebrush production declined in 2005 (0.73 inches) following a winter with below average snowfall but above average precipitation for the entire water year. Because a water year extends from October through September, precipitation for water year 2005-2006 has not been analyzed but sagebrush production on the Mesa, measured in 2006, was least of all 3 years, averaging only 0.12 inches (Scribner, 2006).

Annual sagebrush growth appears to be related to moisture from winter snowfall. Because total snowfall (October through April) in the PAPA has been below the 30-year average of 58 inches since 1987 (except during winter 2003-2004, see Section 3.3), sagebrush production, and most likely production of other plants in the PAPA, has been limited. WGFD data indicates very few young sagebrush plants in the region with most plants classified as mature or decadent (Scribner, 2006).

Invasive nonnative species, many of which are classified as noxious weeds, are very aggressive and have the ability to dominate many sites with dramatic impacts to native plant communities. Wildlife habitat deteriorates, erosion increases, water quality diminishes, nutrient cycling and infiltration are altered, and recreational values are degraded (BLM, 1997). Weeds are often able to establish in areas following surface disturbance and are primarily present along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2003c). According to the Wyoming Cooperative Agricultural Pest Survey (CAPS), there are 13 state-designated noxious weeds and two county-declared weeds in Sublette County (Wyoming Weed and Pest Council, 2006). The declared county weeds are black henbane and scentless chamomile. Only black henbane was considered in the PAPA DEIS (BLM, 1999a). Table 3.18-2 lists the CAPS weeds and their estimated acreages in Sublette County.

Table 3.18-2
Wyoming Designated Noxious Weeds in Sublette County

Common Name Scientific Name	Estimated Area (acres) in County for 2003	Wyoming Designated Noxious Weed [1]	Sublette County Declared Weed [2]	Weed of Concern in PAPA DEIS
Black henbane *Hyoscyamus niger*	1-100	No	Yes	Yes
Canada thistle *Cirsium arvense*	5,000-20,000	Yes	–	Yes
Common tansy *Tanacetum vulgare*	1-100	Yes	–	No
Dyer's Woad *Isatis tinctoria*	1-100	Yes	–	Yes
Hoary cress (whitetops) *Cardaria draba*	100-1,000	Yes	–	Yes
Leafy spurge *Euphorbia esula*	1-100	Yes	–	Yes
Musk thistle *Carduus nutans*	1-100	Yes	–	Yes
Perennial pepperweed *Lepidium latifolium*	1,000-5,000	Yes	–	Yes
Perennial sowthistle *Sonchus arvensis*	1-100	Yes	–	Yes
Quackgrass *Agropyron repens*	1-100	Yes	–	No
Russian knapweed *Centaurea repens*	100-1,000	Yes	–	Yes
Scentless chamomile *Matricaria perforate*	1-100	No	Yes	No
Spotted knapweed *Centaurea maculosa*	1-100	Yes	–	Yes
Yellow toadflax *Linaria vulgaris*	1-100	Yes	–	No

[1] A Designated Noxious Weed listing provides the State of Wyoming legal authority to regulate and manage noxious weeds.
[2] A County Declared Weed listing provides that county with legal authority to regulate and manage noxious weeds.
Source: Wyoming Weed and Pest Council, 2006.

3.18.2 Pipeline Corridors and Gas Sales Pipelines

Vegetation along the proposed corridor/pipeline alignments consists primarily of sagebrush steppe with a limited grassland component. Wetlands and riparian communities are present at locations where the alignments cross the New Fork, Green, and Blacks Fork rivers. Species composition and habitat types vary depending on soil type, salinity, exposure, and moisture levels. Precipitation is a limiting factor for vegetation in the Green River Basin and the vegetative communities are dominated by species that require little water and can exist on aridic soils.

The sagebrush steppe vegetative community is widely distributed within and along the proposed corridor/pipeline alignments and is most often associated with valley bottoms and plateaus. Sagebrush density and distribution varies from sparse low-structure sagebrush interspersed with grasses and forbs in the understory, to other areas more densely vegetated by sagebrush. The species that commonly occur in this community include basin big sagebrush, Wyoming big sagebrush, sand sagebrush, rubber rabbitbrush, black greasewood, prickly pear cactus, spiny hopsage, Indian ricegrass, needle-and-thread grass, and western wheatgrass.

Grassland communities along the proposed corridor/pipeline alignments are generally limited in size. They are principally found on existing pipeline rights-of-way. Small patches occur along the proposed alignments. While species vary by soil type and ground use history, they include western wheatgrass, thickspike wheatgrass, Indian ricegrass, Sandberg bluegrass, and needle-and-thread grass. Wyoming big sagebrush, rabbitbrush, broom snakeweed, winterfat, and greasewood are common shrubs of this grass community.

Recently disturbed corridors from existing pipeline rights-of-ways are susceptible to infestations of invasive/noxious weeds such as Canada thistle, musk thistle, black henbane, and halogeton. Field surveys in 2006 revealed that halogeton is present in many areas along the existing pipeline rights-of-ways (Grasslands, 2006). Table 3.18-3 contains a list of invasive non-native species in Sublette, Sweetwater, and Uinta counties that are known or suspected to occur (Wyoming Weed and Pest Council, 2006).

Table 3.18-3
Invasive Nonnative Species Known to Occur
in Sublette, Sweetwater, and Uinta Counties that May
Occur Along the Proposed Corridor/Pipeline Alignments

Common Name Scientific Name	Sublette County	Sweetwater County	Uinta County
Black henbane *Hyoscyamus niger*	present	present	present
Scentless chamomile *Anthemis arvensis*	present		
Field scabious *Knautia arvensis*	present		
Western water hemlock *Cicuta douglasii*	present		
Foxtail barley *Hordeum jubatum*		present	
Lady's bedstraw *Galium verum*		present	
Mountain thermopsis *Thermopsis Montana*		present	
Yellow starthistle *Centaurea solstitialis*			present

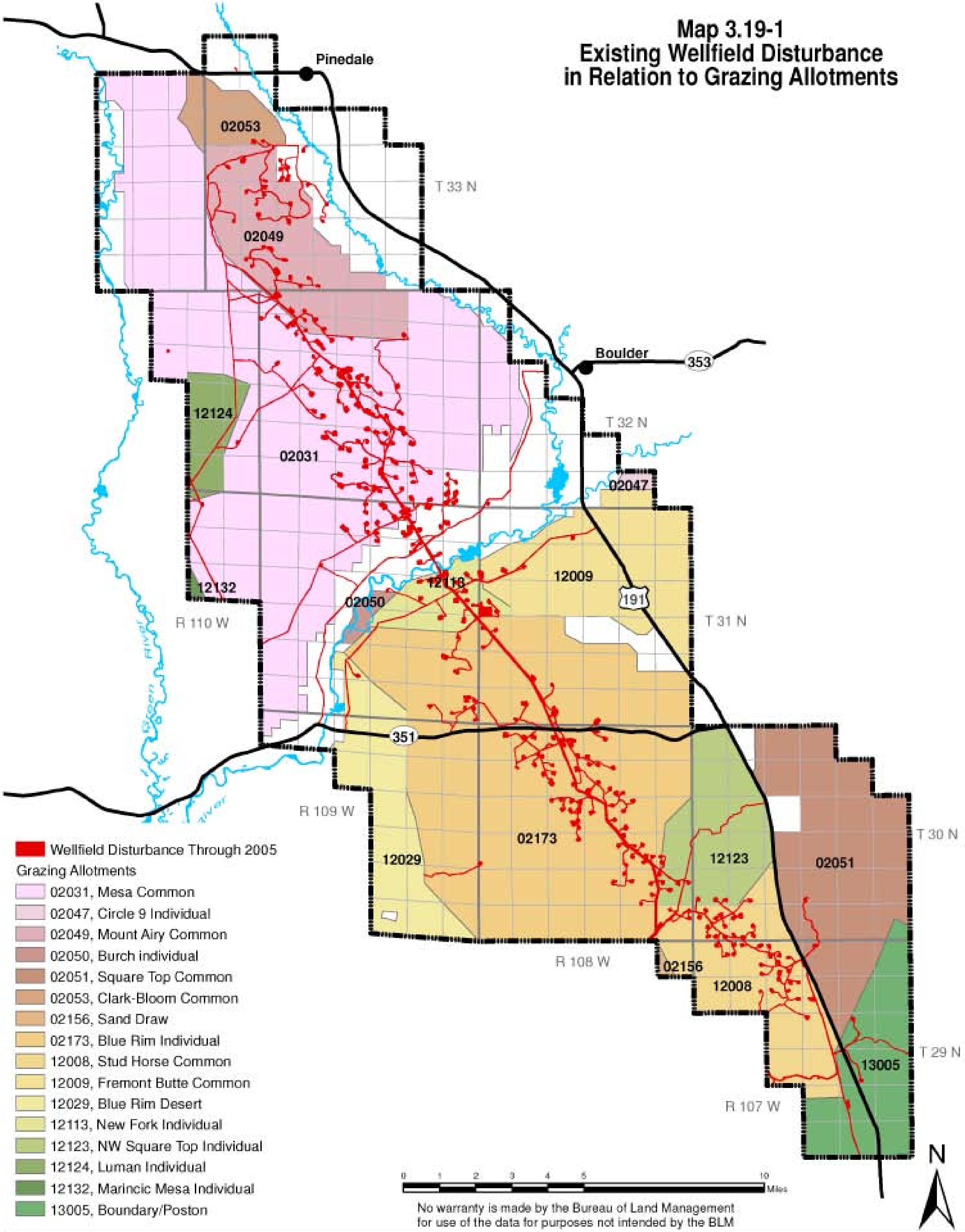
3.19 GRAZING RESOURCES

3.19.1 Development Within the PAPA

There are 50 permittees on the 16 livestock grazing allotments that coincide with the PAPA (Map 3.19-1) and that were listed in the PAPA DEIS (BLM, 1999a). The management categories for area allotments have not changed since the PAPA ROD was issued (BLM, 2003a). There have been no changes to the grazing capacity (animal unit months or AUMs) since the PAPA DEIS (Schultz, 2006). Approximately 37,000 (maximum restriction) livestock are stocked within various allotments and various times during the annual cycle. Most livestock are cattle, although some permittees graze limited numbers of horses. There are approximately 165,738 allotted acres in the PAPA.

No revised or new allotment management plans have been initiated in the PAPA, although several range improvement projects have been implemented since 2000, including erosion control and water development. The BLM, permittees, and some Operators have coordinated several projects to provide better water sources for livestock. There have been multiple water development projects (wells, stock tanks, livestock reservoirs) in the various allotments in the PAPA. Many of those allotment improvements can be seen below, on Map 3.20-1, indicated as point locations included within the Wetland SRMZ.

BLM has reported inadequate fencing around pits and tanks. Increased vehicular traffic has caused several livestock deaths in the PAPA since the PAPA ROD (BLM, 2000b) was issued.


Map 3.19-1
Existing Wellfield Disturbance
in Relation to Grazing Allotments
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
02053
02049
02031
12124
12132
02050
12113
12009
02047
02173
12029
12123
02051
02156
12008
13005
Wellfield Disturbance Through 2005
Grazing Allotments
02031, Mesa Common
02047, Circle 9 Individual
02049, Mount Airy Common
02050, Burch individual
02051, Square Top Common
02053, Clark-Bloom Common
02156, Sand Draw
02173, Blue Rim Individual
12008, Stud Horse Common
12009, Fremont Butte Common
12029, Blue Rim Desert
12113, New Fork Individual
12123, NW Square Top Individual
12124, Luman Individual
12132, Marincic Mesa Individual
13005, Boundary/Poston
0 1 2 3 4 5 10 Miles
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for use of the data for purposes not intended by the BLM
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Increases in wellfield development have contributed to high levels of dust on some areas of forage plants (Schultz, 2006).

In 2003 and 2004, the BLM proposed a 25 percent reduction in PAPA allotment use because of drought (see Section 3.3 and Table 3.3-1, Section 3.18.1, and Appendix K, Wildlife Technical Report). The number of livestock grazing on the BLM allotments was moderately reduced during that time (Schultz, 2006). In 2005, moisture levels and range conditions improved, and the 2005 grazing season returned to normal levels and permitted numbers.

The PAPA DEIS (BLM, 1999a) indicated that different allotments coinciding with the PAPA were capable of supporting varying levels of livestock according to estimates of the average area (acres) required to support one AUM, or acres per AUM. Thus, the most land to support one AUM was within the Marincic Mesa Individual allotment (No. 2132), which averaged 16.92 acres per AUM. The least land to support one AUM was in the Luman Individual allotment (No. 2124), which averaged 4.92 acres per AUM. With data for all allotments combined, the average area required to support one AUM for the entire PAPA is estimated to be about 10.52 acres or an average of 0.095 AUM per acre.

Grazing allotments that coincide with the PAPA have been affected to varying degrees by wellfield disturbance (Table 3.19-1 and Map 3.19-1). Before the PAPA ROD (BLM, 2000b) was issued, there had been relatively few surface disturbances within any single allotment. The allotments most affected since the PAPA ROD was issued are on the Anticline Crest.

As of December 2005, the amount of surface disturbance in all allotments was approximately 4,094 acres, which would support 389 AUMs, using the average AUMs per acre on the PAPA discussed above. In 2006, 336 acres are projected to be disturbed, which is approximately 32 AUMs (Table 3.19-1). Most surface disturbance in the PAPA that is not yet revegetated would be reclaimed, and so estimated loss of AUMs is a current condition but is expected to be temporary.

Table 3.19-1
Estimated Existing Wellfield Disturbance in Relation to Grazing Allotments in the PAPA

Allotment and Number	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Blue Rim Individual (2173)	40,488	1,294.2	107.7	1401.9	3.5
Circle 9 Individual (2124)	429	0.0	0.0	00.0	0.0
Clark-Bloom Common (2053)	2676	35.3	4.7	40.0	1.5
Blue Rim Desert (2029)	7809	15.5	0.0	15.5	0.2
Fremont Butte Common (2009)	11,249	77.7	3.7	81.4	0.7
Luman Individual (2124)	2644	11.4	0.0	11.4	0.4
Marincic Mesa Individual (2132)	184	0.2	0.0	0.2	0.1
Mesa Common (2031)	48309	1278.5	146.9	1425.4	3.0
Mount Airy Common (2049)	9512	359.0	19.6	378.6	4.0
New Fork Individual (2113)	2,604	280.4	40.4	320.8	12.3
Burch (2050)	662	7.9	0.0	7.9	1.2
Northwest Square Top Individual (2123)	6,841	112.9	9.8	122.7	1.8
Square Top Common (2051)	15000	62.1	0.0	62.1	0.4
Stud Horse Common (2008)	9920	505.0	3.0	508.0	5.1
Boundary/Poston (13005)	7266	54.2	0.0	54.2	0.7
Sand Draw (2156)	145	0.0	0.0	0.0	0.0
Total	**165,738**	**4,094.3**	**335.8**	**4430.1**	**2.7**

3.19.2 Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would cross portions of 13 grazing allotments within the Pinedale, Rock Springs and Kemmerer field offices (Table 3.19-2). Most of these allotments are designated for use by sheep and cattle or by cattle only. Season of use varies among allotments.

Table 3.19-2
Grazing Allotments Potentially Crossed by the Proposed Corridor/Pipeline Alignments from North to South

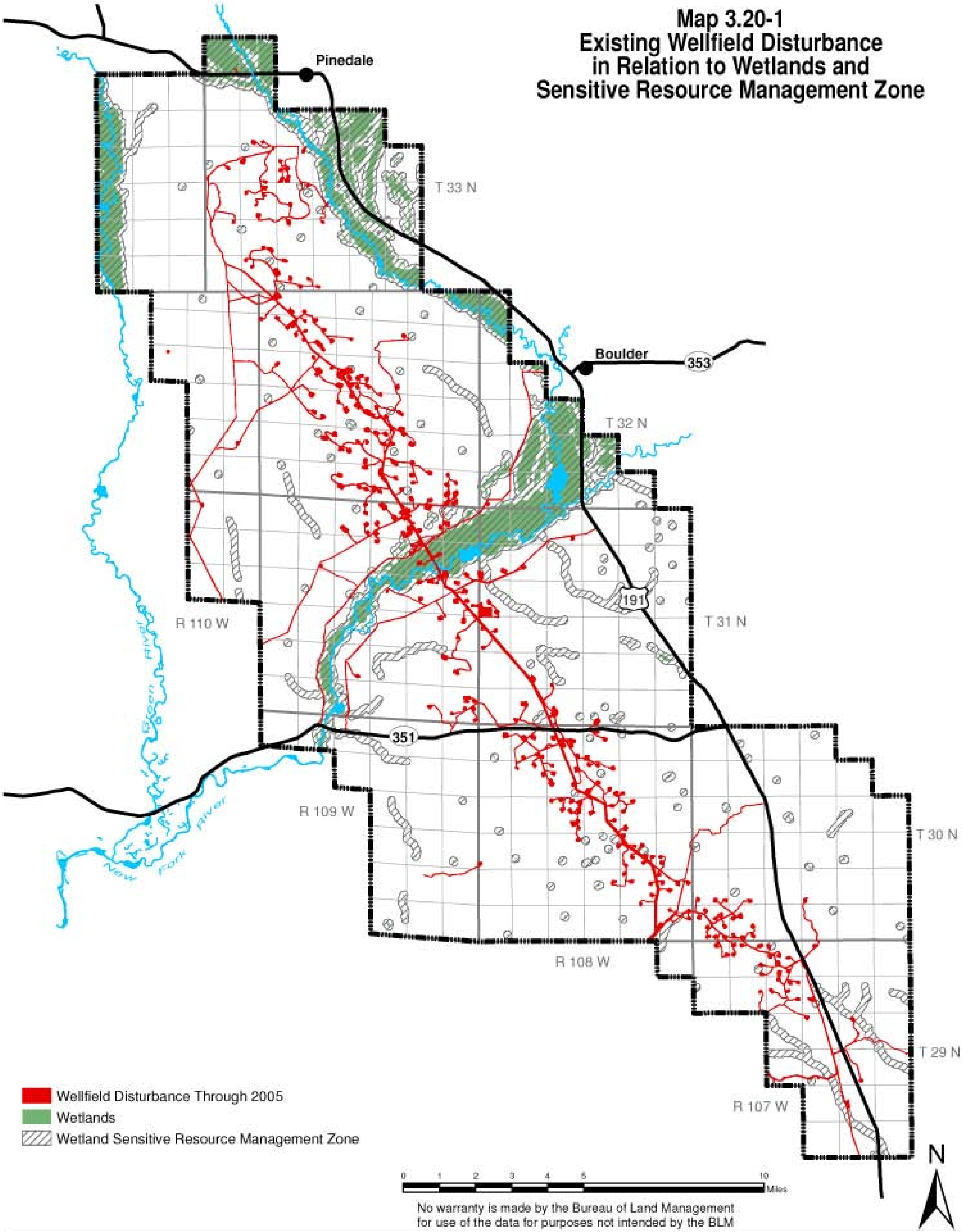
Allotment	Allotment Area (acres)	Allotment AUMs	Livestock Type	Season of Use
Mesa Common (2031)[1]	55,789	4,701	Cattle/horses	5/16-6/25 10/1-11/15
New Fork Individual (2113)[1]	1,850	302	Cattle	5/10-6/20
Blue Rim Individual (2173) [1]	36,585	3,258	Cattle	5/10-6/23
Sand Draw (2156)[1]	31,740	2,324	Cattle	5/1-6/26
Blue Rim Desert (2029)[1]	39,609	2,826	Cattle	5/1-6/21
South Desert (2040)[1]	34,564	2,621	Cattle	5/1-8/23
Figure Four (13023)[2]	114,425	6,644	Sheep/cattle	5/10-1/10
Eighteen-Mile (13017)[2]	228,840	18,994	Sheep/cattle	5/1-1/31
Lombard (13022)[2]	94,802	6,643	Sheep/cattle	5/1-1/31
Seedskadee (11112)[3]	12,555	298	Horse Sheep/cattle	All year 5/1-12/31
Slate Creek (11113)[3]	267,048	20,780	Sheep/cattle	4/15-11/30
Granger Lease (11302)[3]	467,059	20,430	Sheep/cattle	Dec-Apr/May-Oct
1=Pinedale, 2=Rock Springs, 3=Kemmerer Source: Schulz, 2006; D'Ewart, 2006 and Burgin, 2006.				

3.20 WETLANDS, RIPARIAN RESOURCES AND FLOOD PLAINS

3.20.1 Development Within the PAPA

Wetlands are subject to protection under federal law and Executive Order 11990, regardless of land ownership. The EPA and COE use the following definition of wetland for administering the Clean Water Act's Section 404 permit program for dredge and fill activities: *those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas* (40 CFR Part 230.3 and 33 CFR Part 328.3).

Wetlands have three essential characteristics: 1) hydrophytic vegetation; 2) hydric soils; and 3) wetland hydrology (BLM, 1999a). Riparian areas adjacent to perennial streams, such as the Green and New Fork rivers, usually contain willow and cottonwood communities, wet meadows, and irrigated fields that are all likely to exhibit wetland characteristics. Riparian areas adjacent to intermittent and ephemeral streams (Lovatt Draw, North Alkali Draw, Sand Draw, and Sand Springs Draw) may also contain wetlands where seasonal flows and high water tables are present. For reasons discussed in the PAPA DEIS (BLM, 1999a), all wetlands in the PAPA were identified as the Wetland SRMZ. Consistent with BLM's policy to protect a 500 foot buffer from wetland boundaries, the Wetland SRMZ includes 500 feet from wetlands, including non-jurisdictional wetlands not subject to protection under 40 CFR Part 230.3, 33 CFR Part 328.3, and Executive Order 11990 (Map 3.20-1).


Map 3.20-1
Existing Wellfield Disturbance
in Relation to Wetlands and
Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Wetlands
Wetland Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
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In addition to the Wetland SRMZ, the 100-year flood plain, as identified by the Federal Emergency Management Agency, was determined to be the Flood Plain SRMZ (Map 3.20-2) in the PAPA DEIS (BLM, 1999a). The Sublette County Zoning and Development Regulations specifically address development in flood areas (Chapter III, Section 13). The county regulations define a floodway as *"that area of the county, including the channel of any water course, stream or river, required to effectively carry and discharge flood waters, that is inundated by the ten year recurrence interval flood.*" The County's development standards prohibit the placement of any structures in any floodway. In flood areas, where groundwater level is within 4 feet of the surface, all structures and site improvements must be designed to minimize groundwater pollution or contamination.

Since issuance of the PAPA ROD (BLM, 2000b), relatively little surface disturbance associated with wellfield development has occurred in wetlands (Table 3.20-1). Most of the surface disturbance (22 acres) has been generated during pipeline construction since July 2000. There is additional surface disturbance within the 500-foot zone surrounding every wetland that defines the Wetland SRMZ. In that zone, most disturbances have been due to road construction, with approximately equal contributions from well pads and pipelines (Table 3.20-1). Similar to wetlands, there have been relatively few surface disturbances within the 100-year flood plain and within the Flood Plain SRMZ (Map 3.20-2). Most disturbances have been due to pipeline construction.

Table 3.20-1
Estimated Existing Wellfield Disturbance in Relation to Wetlands, the Wetland SRMZ, and Flood Plains in the PAPA

Sensitive Resource	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Wetlands	13,482	131.3	18.4	149.7	1.1
Wetland SRMZ	17,963	248.8	26.3	275.1	1.5
100-Year Flood Plain and Flood Plain SRMZ	11,022	160.4	21.6	182.0	1.7

[1] Only includes jurisdictional wetlands defined in the FWS National Wetland Inventory.

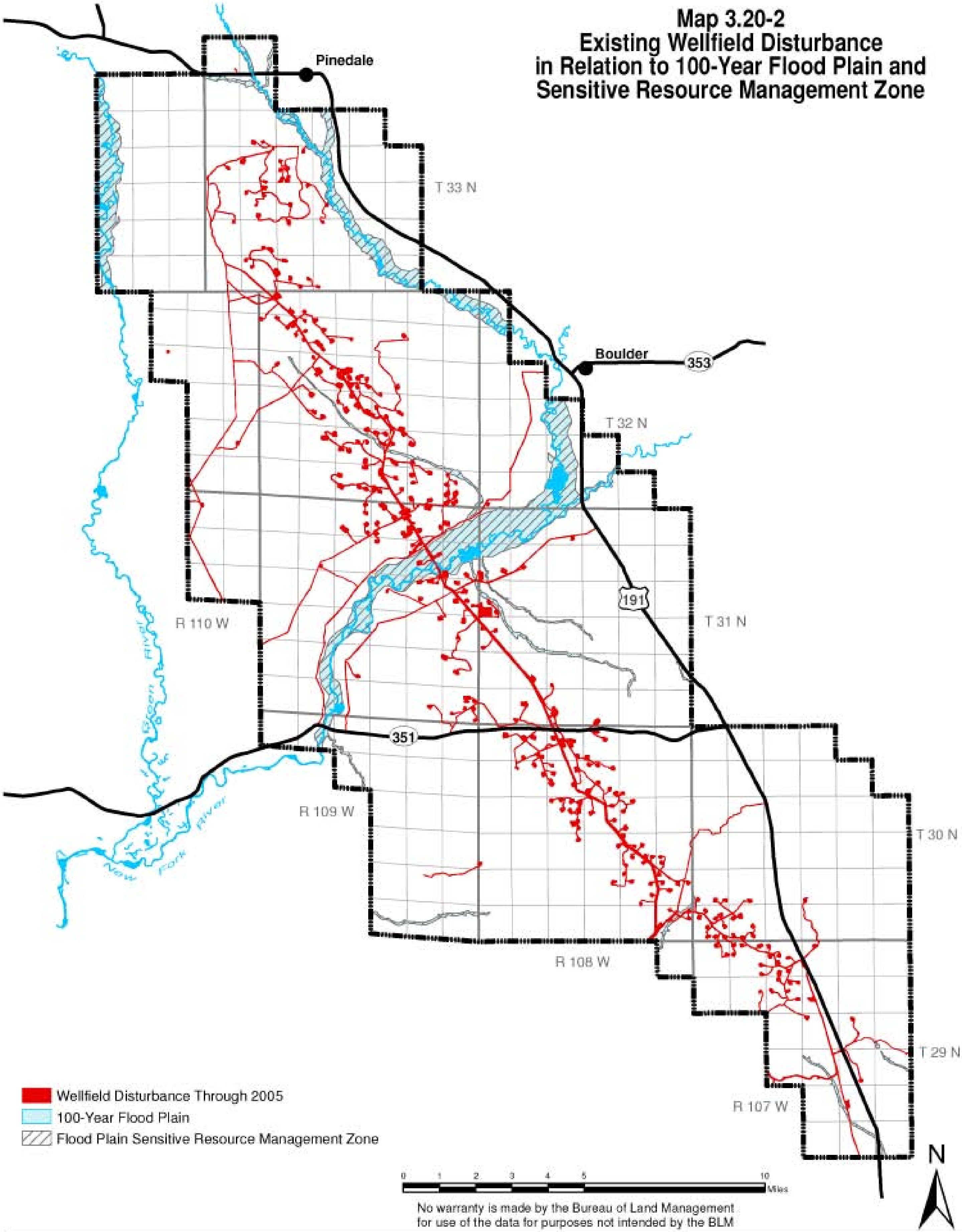
Wetlands in Table 3.20-1 include wet meadows and all of the irrigated hay fields and pastures above the New Fork River's flood plain that may not be jurisdictional wetlands. Most of the wetlands in the PAPA occur along the flood plains of the Green and New Fork rivers and most (96 percent) are on private and state lands. Because of agriculture and residential developments on private lands, the total areas affected by various human-related disturbances to wetlands and the Wetland SRMZ before approval of the PAPA ROD (BLM, 2000b) is quite extensive (Table 3.20-1). Disturbance, especially associated with agriculture, is vegetated, unlike well pads and roads that have been constructed in the Wetland and Flood Plain SRMZs since July 2000.

In 2006, the Operators are projecting an additional 381 acres of disturbance. At the end of 2006, an estimated 18 acres are projected in wetlands, while 22 acres are projected in the Wetland SRMZ and 26 acres in the Flood Plain SRMZ (Table 3.20-1).

3.20.2 Pipeline Corridors and Gas Sales Pipelines

Along the proposed corridor/pipeline alignments, wetlands are limited in extent and are only present along the river banks of the Blacks Fork and Green rivers and in the flood plain of the New Fork River at the proposed crossing locations. Wetlands are primarily expressed as

Map 3.20-2 Existing Wellfield Disturbance in Relation to 100-Year Flood Plain and Sensitive Resource Management Zone



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emergent herbaceous vegetation consisting of sedges and rushes. This wetland vegetation type is present along the river banks of the Blacks Fork and Green rivers. Emergent wetlands are present within the flood plain of the New Fork River. The flood plain also supports forest-dominated riparian habitats with mostly willows and cottonwoods.

3.21 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

3.21.1 Development Within the PAPA

3.21.1.1 Federally Listed, Proposed, and Candidate Species

At the time the PAPA DEIS (BLM, 1999a) was prepared, Ute ladies'-tresses orchid, black-footed ferrets, bald eagles, whooping cranes, and four species of Colorado River fish were species listed under the Endangered Species Act (ESA) that were considered potentially vulnerable to development in the PAPA. Canada lynx and mountain plover were species proposed for listing, and swift fox was a candidate species for listing under the ESA. Since 2000, Canada lynx have been listed as threatened (FWS, 2000) while the proposal to list mountain plovers as threatened was withdrawn (FWS, 2003b). Swift fox is no longer considered to occur in the region.

Recently, the FWS (2005b) in a written communication to the BLM identified the following species that could be affected by natural gas developments in the PAPA: black-footed ferret (endangered), Kendall Warm Springs dace (endangered), Colorado River fish (endangered), bald eagle (threatened), grizzly bear (threatened), Canada lynx (threatened), Ute ladies'-tresses orchid (threatened), and gray wolf (experimental population). Although they were addressed in the PAPA DEIS (BLM, 1999a), whooping cranes (endangered) are not included because the last surviving crane in the population died in 2002 (Whooping Crane Conservation Association, 2004). There are other species that are candidates for listing (yellow-billed cuckoos), and that FWS (2005b) identified as sensitive (greater sage-grouse and pygmy rabbit).

Black-footed Ferret. Historical evidence suggests that black-footed ferrets occurred in the Green River Basin. Ferrets are closely associated with prairie dog colonies, like those in sagebrush-grasslands (Cerovski et al., 2004). The FWS (2004a) evaluated the potential for prairie dog colonies in Wyoming to support black-footed ferrets. As a result, the FWS has determined there are many areas in the state not likely to be inhabited by the species, based on habitat quality and likelihood that ferrets, if ever they were present, are now extirpated. The FWS (2004a) determined that approximately 64 square miles of the PAPA (all or portions of Townships 29 through 31 North, and Ranges 109 through 111 West) are within the Big Piney Prairie Dog Complex, in which surveys for black-footed ferrets are recommended. The remainder of the PAPA has been cleared for further need to conduct surveys for the species (FWS, 2004a).

Kendall Warm Springs Dace. This species is restricted to Kendall Warm Springs, an aggregation of thermal seeps and springs that eventually flow into the Green River. The population is limited to approximately 980 feet of pools and stream segment, all within the Bridger-Teton National Forest (FWS, 1982), approximately 30 miles north of Pinedale.

Colorado River Fish. The FWS (2005b) has indicated that the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker may inhabit the Colorado River System downstream from the PAPA in the Green River. Prior to construction of Flaming Gorge Reservoir, populations of pikeminnows and bonytails may have been viable in the Green River, although they are now extirpated (Baxter and Stone, 1995).

Bald Eagle. The FWS proposed to remove the bald eagle from the list of threatened and endangered species in 1999 (FWS, 1999); but delisting has not occurred and they remain a threatened species. Bald eagles nesting in northwestern Wyoming have been increasing steadily since 1978 (Patla et al., 2003). Bald eagles nest in trees, including cottonwoods, and in riparian zones associated with large lakes and streams (Cerovski et al., 2004).

Wintering bald eagles regularly occur in western Wyoming, generally from November 1 through April 15 (FWS, 2005b), and may occur during any time of year along the Green River corridor. Observations of bald eagles and other wintering birds are reported by the Audubon Society's Christmas Bird Counts. These counts were made near the PAPA during December 1984 and 1987, and only one bald eagle was reported in each year. Migratory bald eagles have been observed during April and November generally throughout the Green River Basin (Patla, 2004), which is also potential bald eagle nesting and roosting habitat. Bald eagles arrive on the Green River the second week of October, coinciding with kokanee salmon and brown trout spawning, which are probably a primary source of autumn food (BLM, 1995). During February 2005, the BLM conducted a winter ground survey of bald eagles within the PFO Administrative Area. A total of 54 eagles were counted, most of them along the Green River and tributaries, although 10 eagles were documented along the New Fork River between Boulder and its confluence with the Green River. Most bald eagle observations during surveys were associated with forest-dominated riparian cover. During the February 2006 survey, eight bald eagles were documented along the New Fork River.

In 2004 and 2005, there were two active bald eagle nests within the PAPA, each producing two young (Patla, 2005). Both nests were active again in 2006 with adults incubating during early April (Patla, 2006). One of the nests was discussed in the PAPA DEIS (BLM, 1999a) and was active in 1999. In Wyoming, bald eagle eggs hatch around May 1, and young fledge about July 10 (Johnsgard, 1986). However, nest building may be initiated during February (Call, 1978 and FWS, 2005b). Fledged juvenile bald eagles may remain in the nest vicinity for a month, often through August (Isaacs et al., 1983 and FWS, 2005b).

Since the issuance of the PAPA ROD (BLM, 2000b), one well pad was constructed within 1 mile of one of the bald eagle nests in 2004. In addition, 17 miles of road and 12.5 miles of pipeline were constructed within 1 mile of the two nests. Prior to July 2000, however, there had been considerable surface disturbance within 1 mile of both nest sites, primarily due to agricultural facilities, residences, and roads (Table 3.21-1). Highway 191 is within 1 mile of one nest and the Boulder South Road is within 1 mile of the other. Before July 2000, eleven well pads had been constructed within 1 mile of bald eagle wintering habitat along the New Fork River riparian zone. Since then, 29 more well pads have been constructed within that 1 mile zone. By the end of 2005, a total of 626 acres had been disturbed by wellfield development within 1 mile of the New Fork River riparian zone. By the end of 2006, four more pads are expected to be constructed within 1 mile of the New Fork River riparian zone and those, along with associated roads and pipelines, are estimated to disturb an additional 57 acres (Table 3.21-1).

Table 3.21-1
Estimated Existing Wellfield Disturbance in Relation to 1-Mile Buffer of Bald Eagle Habitats in the PAPA

Habitat Component	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
1 mile of Active Bald Eagle Nests	4,000	48.7	0.0	48.7	1.2
1 mile of New Fork River Riparian Zone	38,160	766.1	62. 0	828.1	2.2
Forested Dominated Riparian Vegetation	4,036	49.0	15.9	64.9	1.6

Grizzly Bear. The entire PAPA is outside of the outer boundary for grizzly bear occupancy established in the Wyoming Grizzly Bear Management Plan (Moody et al., 2002). In the plan, the WGFD's policy is to limit bear occurrence outside of the boundary, with the intent to exclude them from becoming reestablished in other areas of the state.

The grizzly bear has a wide range of habitat tolerance. The preferred habitat for grizzly bears is typically contiguous, relatively undisturbed mountainous habitat with a high topographic gradient and vegetative diversity. Among other food sources, grizzlies feed on winter-killed big game carrion, often encountered on big game winter ranges, including those in the PAPA. Otherwise, suitable habitat for the species is not present in the PAPA.

Canada Lynx. A reproducing population of Canada lynx has been documented near Merna where they prey on snowshoe hares (Laurion and Oakleaf, 1998). Lynx are generally associated with dense coniferous forests (Englemann spruce-subalpine fir) at high elevations (Cerovski et al., 2004). Suitable habitats for lynx are not present in the PAPA.

Ute Ladies'-tresses orchid. Except for its possible occurrence along the Green River, this species was not addressed in the PAPA DEIS (BLM, 1999a). Examination of the location revealed unsuitable habitat. Ute ladies'-tresses orchid was listed as threatened in 1992 (FWS, 1992). In Wyoming, Ute ladies'-tresses orchid have been located on old oxbows or flood plain terraces associated with small streams on sites that remain moist (meadow plant communities) throughout the summer, whether due to seasonal flooding or sub-irrigation (Fertig, 2000). All four of the known populations in the state occur in Wyoming's eastern half. Searches were conducted in western Wyoming (Jackson Hole, National Elk Refuge and Green River Basin) during the 1990s (Fertig, 2000). Given the elevation ranges and precipitation regimes associated with site occurrence, the species' presence within the PAPA is unlikely. The FWS (2004c) is undertaking a 5-year status review of Ute ladies'-tresses orchid to determine if delisting the species is warranted.

Gray Wolf. Since the reintroduction of 31 animals in Yellowstone National Park (YNP) during 1995 and 1996, the gray wolf population in the Greater Yellowstone Recovery Area during 2003 included approximately 89 animals in Wyoming inhabiting areas outside of YNP (FWS et al., 2004). By 2005, there were 134 wolves in Wyoming outside of YNP and 252 wolves in the state's portion of the Greater Yellowstone Recovery Area (FWS et al., 2006). The animals are classified as a nonessential experimental population (FWS, 2005b). Gray wolves inhabit coniferous forests as well as shrub and grasslands in mountains and foothills, where they feed on big game and smaller prey species (Cerovski et al., 2004).

Packs have become established outside of YNP including two packs near the PAPA: the Green River Pack east of the PAPA in the upper Green River Basin in 2002, and the Daniel Pack northwest of the PAPA in 2003 (FWS et al., 2004). Since their establishment, both wolf packs have preyed on cattle and sheep and pack members in both packs have been killed in control actions. Wolves dispersed to the Pinedale/Cora area and were subsequently killed after repeated livestock depredations (FWS et al., 2005). In 2006, a total of 22 wolves had been killed by federal officials in Sublette County, including the last adult member of the Green River Pack and members of a pack that had become established near Prospect Mountain, east of Farson. All were killed after repeated documented livestock depredations (Urbigkit, 2006).

During winter 2002-2003, wolves killed two elk (both in the Pinedale Elk Herd Unit) on two of the three elk wintering feedgrounds: Fall Creek and Scab Creek (Clause, 2006a). Wolves killed 16 elk on the Black Butte and Soda Lake feedgrounds within the Green River Elk Herd Unit during 2003 (Clause, 2006b). Although portions of both elk herd units coincide with the PAPA, only the northern portion coincides with the winter range utilized by elk in the Green River Herd Unit. While unlikely, wolves could potentially be present near the PAPA.

Yellow-billed Cuckoo. This species was petitioned for listing in 1998. Following a status review, the FWS (2001) found that listing the western distinct population segment of yellow-billed cuckoos (including those in Wyoming) as threatened was warranted but precluded and the species is currently a candidate for listing (FWS, 2005b). The species is found in eastern Wyoming where it is associated with deciduous woods and thickets along riparian zones (Dorn and Dorn, 1990; Cerovski et al., 2004).

No yellow-billed cuckoos have been documented in the upper Green River Basin, although breeding may have occurred southeast of the basin (Cerovski et al., 2004). There are nine National Biological Survey Breeding Bird Survey (BBS) routes in the upper Green River area, some of which have been surveyed since 1980, although none with continuous records since then. Yellow-billed cuckoos have not been reported in any of the surveys in the PAPA vicinity. Further, BBS routes in 2002 on BLM lands that included the PAPA did not detect the species (McGee et al., 2002).

3.21.1.2 Sensitive Species in the PAPA

Greater Sage-Grouse. The eastern subspecies of greater sage-grouse was petitioned for listing as endangered in 2002. Wyoming is included within the subspecies' range. However, the FWS determined that evidence was lacking to distinguish the eastern subspecies as a valid subspecies, and therefore it is not a distinct population segment applicable under the ESA (FWS, 2004d). A similar evaluation was rendered on a petition to list the western subspecies in 2003.

The FWS completed a status review of the greater sage-grouse and determined that it does not warrant protection under the ESA throughout its range, including Wyoming (FWS, 2005c). Greater sage-grouse are managed as an upland game bird in Wyoming and the species is discussed in Section 3.22.1.2, below. Greater sage-grouse leks, wintering grounds, and nests have been documented within the PAPA.

Pygmy Rabbit. Pygmy rabbits in Washington's Columbia Basin were listed as endangered in 2003 (FWS, 2003c) but that listing does not apply to the species in Wyoming. Pygmy rabbits have been designated as a sensitive species by the BLM (BLM, 2001) as well as by the FWS (FWS, 2005a). Pygmy rabbits use subspecies of sagebrush and other shrub species (like bitterbrush, rabbitbrush, greasewood, snowberry, and juniper) that may be present (Ulmschneider et al., 2004). Burrows are usually hidden under sagebrush. Characteristic pygmy rabbit habitat includes drainages with dense, tall sagebrush. Pygmy rabbits burrow in loamy soils, deeper than 20 inches. Soil composition needs to be able to support a burrow system with numerous entrances and it needs to be soft enough for digging.

Wyoming's pygmy rabbit habitat includes uncharacteristic areas (Wyoming Wildlife Consultants LLC., 2006 and Ulmschneider et al., 2004). In the PAPA, pygmy rabbits have been observed in characteristic (McGee et al., 2002) and uncharacteristic habitats, such as flat areas with short sagebrush (Wyoming Wildlife Consultants LLC, 2006). Often, they are associated with soil mounds near sagebrush. Such mounds can become entire burrowing systems. Pygmy rabbits occur throughout the PAPA (especially on the Mesa) and in the Jonah Field Project Area. The extent of their presence outside these areas is currently unknown (Wyoming Wildlife Consultants LLC, 2006 and Purcell, 2005). Over 30 pygmy rabbit sightings and over 200 burrows were documented in the PAPA in 2005.

Other Special Status Species. In addition to species listed under the ESA, the BLM has identified sensitive species (BLM, 2001) within the Pinedale and Rock Springs resource areas, some of which are known to occur or potentially occur in the PAPA. BLM developed a formal sensitive species list after the PAPA ROD (BLM, 2000b) was issued. BLM sensitive species known to occur in or near the PAPA include: ferruginous hawk, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and white-tailed prairie dog (McGee et al., 2002). Other species' occurrences, listed Table 3.21-2, are judged as possible, unlikely, or highly unlikely based on their habitat requirements and known distributions (Baxter and Stone, 1980; Baxter and Stone, 1995; McGee et al., 2002; and Cerovski et al., 2004).

Species of Special Concern managed by WGFD and which may inhabit the PAPA have been included in Table 3.21-2. Two of the species that are not BLM sensitive, but which are present in the PAPA, are mountain plover and merlin. Observations of mountain plovers and merlins, as well as burrowing owls, have been made on or in the immediate vicinity of the PAPA since 2001, and their status in relation to wellfield development is under investigation (Ecosystem Research Group, 2006).

The BLM (2001) has indicated that the following special status plant species may occur within the Pinedale Resource Area: Cedar Rim thistle, large-fruited bladderpod, Beaver Rim phlox, and tufted twinpod (Table 3.21-3). Trelease's racemose milkvetch could occur if suitable habitat is present.

Table 3.21-2
BLM Sensitive Fish and Wildlife Species and WGFD Species of Special Concern Not Listed Under ESA That Could Occur Within the PAPA, Habitats, and Other Status Designations

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Fish				
Roundtail chub *Gila robusta*	Colorado River drainage in large rivers, streams and lakes	possible	S3	NSS1
Leatherside chub *Gila coperi*	Green River drainage in clear, cool streams and pools	highly unlikely	S1	NSS1
Bluehead sucker *Catostomus discobolus*	Green River drainage, all water types	possible	S3	NSS1
Flannelmouth sucker *Catostomus latipinnis*	Colorado River drainage in large rivers, streams and lakes	present	S3	NSS1
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*	Colorado River drainage, clear mountain streams	unlikely	S1	NSS2
Amphibians				
Northern leopard frog *Rana pipiens*	Beaver ponds, permanent water in plains and foothills	possible	S3	none
Columbia spotted frog *Rana pretiosa*	Ponds, sloughs, small streams	unlikely	S3	none
Western boreal toad *Bufo boreas boreas*	Pond margins, wet meadows, riparian areas	possible	S1	none
Birds				
Snowy egret *Egretta thula*	Marshes, lakes, rivers	possible	S3B	NSS3
White-faced ibis *Plegadis chihi*	Marshes, wet meadows	possible	S1B	NSS3
Trumpeter swan *Cygnus buccinator*	Lakes, ponds, rivers	possible	S2	NSS2
Northern goshawk *Accipiter gentiles*	Conifer and deciduous forests	highly unlikely	S3	NSS4
Merlin *Falco columbarius*	Coniferous or deciduous trees	present	S4	NSS3
American peregrine falcon *Falco pereginus anatum*	Cliffs in most habitats near lakes and rivers	possible	S3	NSS3
Ferruginous hawk *Buteo regalis*	Basin-prairie shrub, grasslands, rock outcrops	present	S5N	NSS3
Greater sage-grouse Centrocercus urophasianus	Basin-prairie shrub, mountain-foothills shrub	present	S4	game bird

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Mountain plover *Charadrius montanus*	Grasslands	present	S2	NSS4
Long-billed curlew *Numenius americanus*	Grasslands, plains, foothills, wet meadows	possible	S3B	NSS3
Yellow billed cuckoo *Coccyzus americanus*	Open woodlands, streamside willow and alder groves	highly unlikely	S1	NSS2
Burrowing owl *Athene cunicularia*	Grasslands, basin-prairie shrub	present	S3	NSS4
Great gray owl *Strix nebulosa*	Coniferous forests, aspen, mountain-foothills grassland	unlikely	S2	NSS4
Loggerhead shrike *Lanius ludovicianus*	Basin-prairie shrub, mountain-foothills shrub	possible	S3	none
Sage thrasher *Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothills shrub	present	S5	NSS4
Grasshopper sparrow *Ammodramus savannarum*	Basin-prairie shrub, wet meadow, grasslands	possible	S4	NSS4
Brewers sparrow *Spizella breweri*	Basin-prairie shrub	present	S5	NSS4
Sage sparrow *Amphispiza belli*	Basin-prairie shrub, mountain-foothills shrub	present	S3	NSS4
Mammals				
Dwarf shrew *Sorex nanus*	Mountain-foothills shrub	unlikely	S4	NSS3
Fringed myotis *Myotis thysanodes*	Coniferous forest, woodland, prairie-basin shrub	possible	S2	NSS2
Long-eared myotis *Myotis evotis*	Conifer and deciduous forests, caves and mines	possible	S4	NSS2
Spotted bat *Euderma maculatum*	Desert sagebrush-grasslands	possible	S3	NSS2
Townsend's Big-eared Bat *Corynorhinus townsendii*	Basin-prairie and mountain-foothills shrub, desert grasslands	unlikely	S2	NSS2
Pygmy rabbit *Brachylagus idahoensis*	Prairie-basin shrub and riparian shrub	present	S1	NSS3
White-tailed prairie dog *Cynomis leucurus*	Grasslands, basin-prairie shrub	present	S3	NSS3
Idaho pocket gopher *Thomomys idahoensis*	Shallow stony soils	highly unlikely	S2	NSS3

[1] State Rank: Assigned by WYNDD and reflects status of species within political borders of the State of Wyoming:
S1 = Extremely rare, S2 = Very rare, S3 = Rare, S4 = Apparently secure, but may be rare in portions of its range, S5 = Secure under present conditions. "B" following state rank indicates breeding status; "N" indicates non-breeding status.

[2] WGFD Status = Wyoming Game and Fish Department Status:
NSS1 = Species with ongoing significant habitat loss, populations greatly restricted or declining, and extirpation appears possible.
NSS2 = Species 1) whose habitat is limited or vulnerable, but no recent or significant loss has occurred and populations are greatly restricted or declining; or 2) with ongoing significant loss of habitat and populations are declining or restricted in numbers and distribution, but extirpation is not imminent.
NSS3 = Species in which 1) habitat is not limited, but populations are greatly restricted or declining and extirpation appears possible; 2) habitat is limited or vulnerable, although no significant recent loss has occurred and populations are declining or restricted in numbers or distribution, but extirpation is not imminent; or 3) significant habitat loss is ongoing, but the species is widely distributed and population trends are thought to be stable.
NSS4 = Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted -OR- Populations declining or restricted in numbers or distribution, extirpation not imminent; Species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance -OR- Populations stable or increasing and not restricted in numbers or distribution; on-going significant loss of habitat.

Sources: BLM, 2001, Keinath et al., 2003; Cerovski et al., 2004

Table 3.21-3
BLM-Sensitive Plant Species Not Listed Under ESA
That Could Occur within the PAPA, Habitats, and Other Status Designations

Common Name Scientific Name	Habitat (BLM, 2002)	Potential Occurrence	State Rank[1]
Meadow pussytoes Antennaria arcuata	Moist, hummocky meadows, seeps or springs surrounded by sage/grasslands 4950-7900' elevation	highly unlikely	S2
Trelease's racemose milkvetch *Astragalus racemosus* var. *treleasei*	Sparsely vegetated sagebrush on shale or limestone outcrops, barren clay slopes, 6500-8200' elevation	possible	S2
Cedar Rim thistle *Cirsium aridum*	Barren, chalky hills, gravelly slopes, fine textured sandy-shaley draws, 6700-7200' elevation	likely	S2
Large-fruited bladderpod *Lesquerella macrocarpa*	Gypsum-clay hills, benches, clay flats, barren hills, 7200-7700' elevation	likely	S2
Beaver Rim phlox *Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, limestone substrates, 6000-7400' elevation	likely	S2
Tufted twinpod *Physaria condensate*	Sparsely vegetated shale slopes, ridges, 6500-7000' elevation	likely	S2

[1] State Rank: assigned by WYNDD and reflects status of species within political borders of the State of Wyoming:
S1 = Extremely Rare
S2 = Very Rare
S3 = Rare
S4 = Apparently secure, but may be rare in portions of its range
S5 = Secure under present conditions
Source: BLM, 2001; Keinath et al., 2003.

3.21.2 Pipeline Corridors and Gas Sales Pipelines

Special status species potentially occurring along the proposed corridor/pipeline alignments include the same federally listed species as those identified as having potential to occur in the PAPA. No suitable habitats are present within the proposed corridor/pipeline alignments corridors for Kendall Warm Springs dace, Canada lynx, grizzly bear, and gray wolf. Occurrences of black-footed ferrets and Ute ladies'-tresses orchid are possible, but unlikely. Bald eagles are likely to occur within riparian zones associated with the Green River and New Fork River. Colorado River fish have been extirpated from the Green River, although they occur downstream in the Colorado River drainage. Greater sage-grouse and pygmy rabbits likely occur along portions of the proposed corridor/pipeline alignments.

All BLM sensitive fish, wildlife, and plant species identified in Table 3.21-2 and Table 3.21-3 that could occur in the PAPA may also occur along the proposed corridor/pipeline alignments. Several additional BLM sensitive species, identified by the BLM Rock Springs and Kemmerer field offices that could occur along the proposed corridor/pipeline alignments are listed in Table 3.21-4.

Table 3.21-4
BLM Sensitive Fish, Wildlife, and Plant Species that, in addition to those in Table 3.21-2 and Table 3.21-3, Could Occur within the Vicinity of the Proposed Corridor/Pipeline Alignments

Common Name Scientific Name	Habitat (BLM, 2001)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Great Basin spadefoot *Spea intermontana*	Springs, seeps, temporary and permanent waters	Unlikely	S3	none
Midget faded rattlesnake *Crotalus viridis concolor*	Mountain foothills shrub and rock outcrops in southwestern Wyoming and adjacent Colorado and Utah	Highly unlikely	S1	none
Swift Fox *Vulpes velox*	Open prairies and arid grasslands, including areas intermixed with winter wheat fields	Highly unlikely	S2	NSS4

Common Name Scientific Name	Habitat (BLM, 2001)	Potential Occurrence	State Rank[1]	WGFD Status[2]
Mystery wormwood *Artemisia biennis var. diffusa*	Only known site is in Sweetwater County along clay flats and playas at 6,500 feet	Highly unlikely	S1	-
Precocious milkvetch *Astragalus proimanthus*	Cushion plant communities on rocky, clay soils mixed with shale on summits and slopes of white shale hills from 6,800-7,200 feet	Highly unlikely	S1	-
Nelson's milkvetch *Astragalus nelsonianus*	Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, and cushion plant communities from 5,200 to 7,600 feet	Unlikely	S2	-
Small rock cress *Boechera (Arabis) pusilla*	Cracks and crevices in sparsely vegetated granite/pegmatite outcrops in sagebrush-grasslands around 8,000 feet	Highly unlikely	S1	-
Ownbey's thistle *Cirsium ownbeyi*	Sparsely vegetated shaley slopes in sage and juniper communities between 6,440-8,400 feet	Highly unlikely	S2	-
Wyoming tansymustard *Descurainia torulosa*	Sparsely vegetated sandy slopes at base of cliffs of volcanic breccia or sandstone from 8,300-10,000 feet	Highly unlikely	S1	-
Entire-leaved peppergrass *Lepidium integrifolium* var *integrifolium*	Sparsely vegetated and seasonally wet clay flats, greasewood communities on clay hummocks, and moist alkaline meadows at 6,200-6,770 feet	Highly unlikely	S1	-
Prostrate bladderpod *Lesquerella prostrate*	Plains, hills, and slopes in sagebrush, grass, and juniper communities in Lincoln and Uinta counties in the Muddy and Upper Bear River Mountains	Highly unlikely	S1	-
Stemless beardtongue *Penstemon acaulis* var *acaulis*	Cushion plant or black sage grassland communities on semi-barren rocky ridges, knolls, and slopes at 5,900-8,200 feet	Highly unlikely	S1	-
Dorn's twinpod *Physaria dornii*	Lincoln and Uinta counties in the Blacks Fork and Muddy drainages on dry, sparsely vegetated, calcareous-shaley slopes and ridges dominated by mountain mahogany and rabbitbrush	Highly unlikely	S1	-
Persistent sepal yellowcress *Rorippa calycina*	Sandy, muddy streambanks, stockponds, reservoirs 3,660-6,800 feet elevation	Unlikely	S2S3	
Green River greenthread *Thelesperma caespitosum*	Occurs along white shale slopes and ridges of the Green River Formation at 6,300 feet	Highly unlikely	S1	-
Uinta greenthread *Thelesperma pubescens*	Sweetwater and Uinta counties in the Upper Green-Flaming Gorge Reservoir and Blacks Fork rivers on very windy rims of extremely coarse-cobbly soils of the Bishop Conglomerate	Highly unlikely	S1	-
Cedar Mountain Easter-daisy *Townsendia microcephala*	Sweetwater and Uinta counties in the Blacks Fork drainage on rocky slopes and cobbley ridges of the Bishop Conglomerate	Highly unlikely	S1	-

[1] State Rank is the same as defined in Table 3.21-2 (vertebrates) and Table 3.21-3 (plants).
[2] WGFD status is the same as defined in Table 3.21-2.

3.22 WILDLIFE AND AQUATIC RESOURCES

3.22.1 Development Within the PAPA

Wildlife habitats and their functions in the PAPA, including wintering, breeding and nesting habitats, were described in detail in the PAPA DEIS (BLM, 1999a) and supporting documents.

Since 2000, there have been several wildlife studies that have provided information that was unavailable when the PAPA ROD (BLM, 2000b) was issued. Some of the new information is presented in the sections below. Further, WGFD (2004b) has developed guidance relevant to current and future natural gas development in the PAPA: *Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats.*

3.22.1.1 Big Game

Pronghorn. The PAPA covers several seasonal ranges utilized by pronghorn in the Sublette Herd Unit (Map 3.22-1). Winter ranges in the PAPA are occupied by pronghorn that migrate from distant summer ranges in Grand Teton National Park (GTNP) and Bridger-Teton National Forest (BTNF). Animals captured and equipped with radio telemetry collars may begin migrating to the PAPA as early as October in some years, or as late as December in others, taking approximately 1 month to complete the trip (Sawyer and Lindzey, 2000).

To reach the PAPA, pronghorn summering in GTNP and BTNF must travel 50 to 80 miles while crossing numerous obstacles, including 47 fences, several highways (including U.S. Highway 191), rivers (Upper Green River and Gros Ventre River), and must pass through proliferating housing subdivisions with associated fences and roads (Sawyer and Lindzey, 2000). One migratory passage of particular concern is a bottleneck in the vicinity of Trappers Point (not shown on Map 3.22-1). The bottleneck is north of the PAPA and is constricted to a 0.5-mile wide zone by the convergence of U.S. Highway 191, State Highway 352, riparian zones of the Green River and New Fork River, and private lands that have been subdivided, developed and fenced (Sawyer and Lindzey, 2000). In 2003, over 21 miles of highway right-of-way fencing was modified to provide better passage for migratory big game (WGFD, 2004c). In 2005, WDOT installed roadside sensors along a 2-mile portion of U.S. Highway 191 that coincides with big game migrations through the Trappers Point Bottleneck. When the sensors detect animal presence, they activate flashing warning signs to alert motorists that large animals are likely to be on the highway. The system, when functional, has successfully detected big game on the highway though it is currently being upgraded (Maxam, 2006).

In the vicinity of this migration corridor constriction, the Trappers Point Bottleneck (Sawyer and Lindzey, 2000), the average daily traffic volume on U.S. Highway 191 at about milepost 100 increased from 3,000 vehicles (230 trucks)/24 hours in 2000 to 5,300 vehicles (340 trucks)/24 hours in 2005 (see Table 3.6-2). Pronghorns have been killed by vehicles along U.S. Highway 191 and State Highway 351 although data collected by WDOT (Carpenter, 2006b) has not shown a trend of mortality related to traffic volume.

Pronghorn returning to GTNP may begin moving in April or earlier, depending on snow conditions (Sawyer and Lindzey, 2000). Pronghorn movements from crucial winter ranges on the southern slopes of the Mesa begin by shifting their distribution to the top of the Mesa, subsequently continuing north on the top and western edge of the Mesa (Sawyer and Lindzey, 2000).

Long-term fawn production data (1978 to 2003) indicate an overall significant decline in the numbers of fawns per doe counted before harvest (BLM, 2004a). However, fawn production increased from 0.60 fawns per doe in 2003 to 0.74 fawns per doe in 2004 (Table 3.22-1). The population decreased to 42,460 animals in 2004, partially due to low fawn production the year before (Frost, 2006). Conversely, the population increased in 2005 due to higher fawn production in 2004 (Table 3.22-1), probably as a result of increased precipitation and shrub growth that year (see Vegetation, Section 3.18.1).

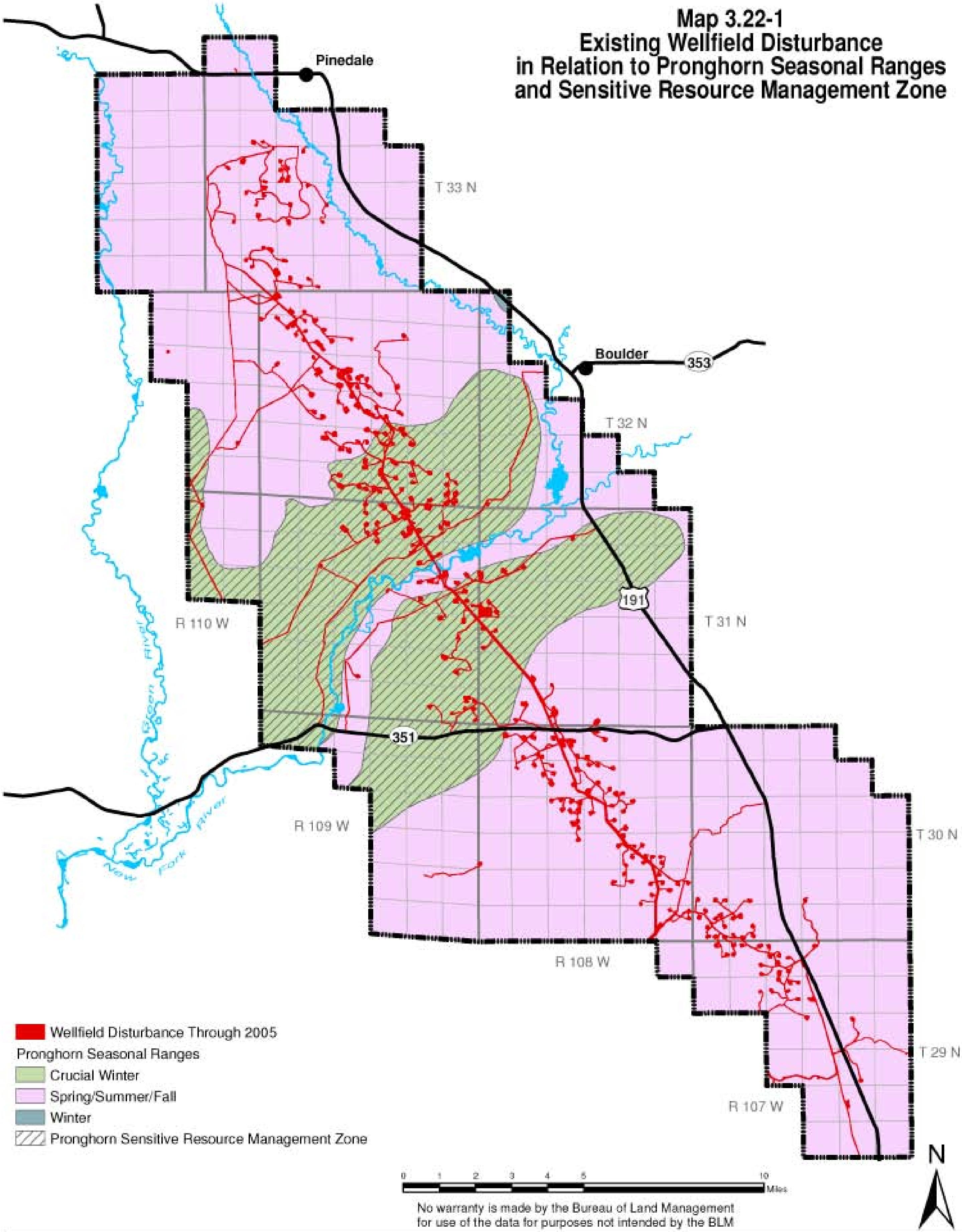
Map 3.22-1
Existing Wellfield Disturbance
in Relation to Pronghorn Seasonal Ranges
and Sensitive Resource Management Zone
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Pronghorn Seasonal Ranges
Crucial Winter
Spring/Summer/Fall
Winter
Pronghorn Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
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Table 3.22-1
Pronghorn Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate[1]	Preseason Fawns per Doe [1]	Harvest [2]			
			Bucks	Does	Fawns	Total
1999	44,191	0.763	2,909	2,113	374	5,396
2000	42,097	0.570	3,447	2,492	343	6,282
2001	43,348	0.619	2,245	1,053	373	3,671
2002	43,630	0.615	2,467	1,477	212	4,156
2003	44,239	0.597	2,435	1,585	161	4,181
2004	42,460	0.740	2,444	1,544	239	4,227
2005	47,930	0.688	2,248	1,583	143	3,974

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Green River Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

Pronghorn fawn production within the entire herd unit increased during 2004, a likely response to increased precipitation during water year 2003-2004. From 1999-2003, harvest had been variable, but generally increased since 2001, especially the doe harvest, which had increased 1.5 times between 2001 and 2003 (Table 3.22-1). Doe harvest since 1999 has been much less than during the 1980s and early 1990s, when harvest exceeded 5,000 does in 1992 (BLM, 2004a).

WGFD began modeling the northern portion of the Sublette Herd Unit population in 1997; that portion includes animals inhabiting the PAPA. Data are provided for the northern Sublette Herd Unit in Table 3.22-2. Of particular interest is fawn production in the northern portion, which is less than in the entire herd unit each year since 1999. Although a likely consequence of decreased precipitation and concomitant decreased shrub production, the reason(s) for the observed variability of fawn production in the northern portion of the herd unit has not been documented.

Table 3.22-2
Pronghorn Northern Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Preseason Fawns per Doe [1]	Harvest [2]			
			Bucks	Does	Fawns	Total
1999	20,006	0.711	1,123	560	80	1,763
2000	18,927	0.525	1,279	685	119	2,083
2001	18,581	0.545	920	377	39	1,336
2002	23,249	0.578	1,056	498	38	1,592
2003	22,290	0.550	1,024	531	50	1,605
2004	21,964	0.680	1,095	543	70	1,708
2005	27,537	0.652	982	614	75	1,671

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Green River Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

Annual adult doe survival rates, estimated from animals radio-collared in GTNP and BTNF, have been high, ranging from 97 percent survival in 1998-1999 to 84 percent survival in 1999-2000 (Sawyer and Lindzey, 2000). A study is currently underway to document pronghorn movements, habitat use, and responses to habitat alterations and disturbance, including natural gas developments in the PAPA (Berger et al., 2006). In the first progress report from the study, Berger et al. (2006) compared several variables between two experimental groups: pronghorn exposed to natural gas development (treatment group) in the PAPA and pronghorn not exposed to the development (control group). In 2006, no significant differences were detected among animals in the two study groups for the following: body mass, stress hormones (fecal corticosteroids), disease antibodies, and vitamins and minerals in blood sera (including polychlorinated biphenyls (PCBs) and organochlorides). While survival rates were lower in the treatment group (69.3 percent) than the control group (95 percent), the difference was not significant (Berger et al., 2006).

Pronghorn were radio-collared to study movements in relation to snow depth and wellfield activities. When snow is deep, larger groups of pronghorn tend to form; snow tended to be deeper in the north end than the south end of the PAPA. Generally, pronghorn kept a distance of 330 feet from well pads, although some individuals spent extensive time near pads (Berger et al., 2006). Preliminary study results suggest that continual fragmentation of previously undisturbed land is leading to reduced use by pronghorn. Pronghorn appear to abandon habitat in parcels with patch sizes at or about 600 acres (Berger et al., 2006).

Most of the PAPA (150,324 acres) coincides with habitats used by pronghorn primarily during spring, summer, and fall (Table 3.22-3). Nearly 25 percent of the PAPA (47,590 acres) is pronghorn crucial winter range. The PAPA DEIS (BLM, 1999a) identified all crucial winter range as the Pronghorn (Antelope) SRMZ (Map 3.22-1). Surface disturbance associated with wellfield development has been proportionately more extensive within crucial winter range than in other seasonal ranges in the PAPA. As of December 2005, there were approximately 4,679 acres of wellfield disturbance in the PAPA (all of which is in pronghorn seasonal ranges).

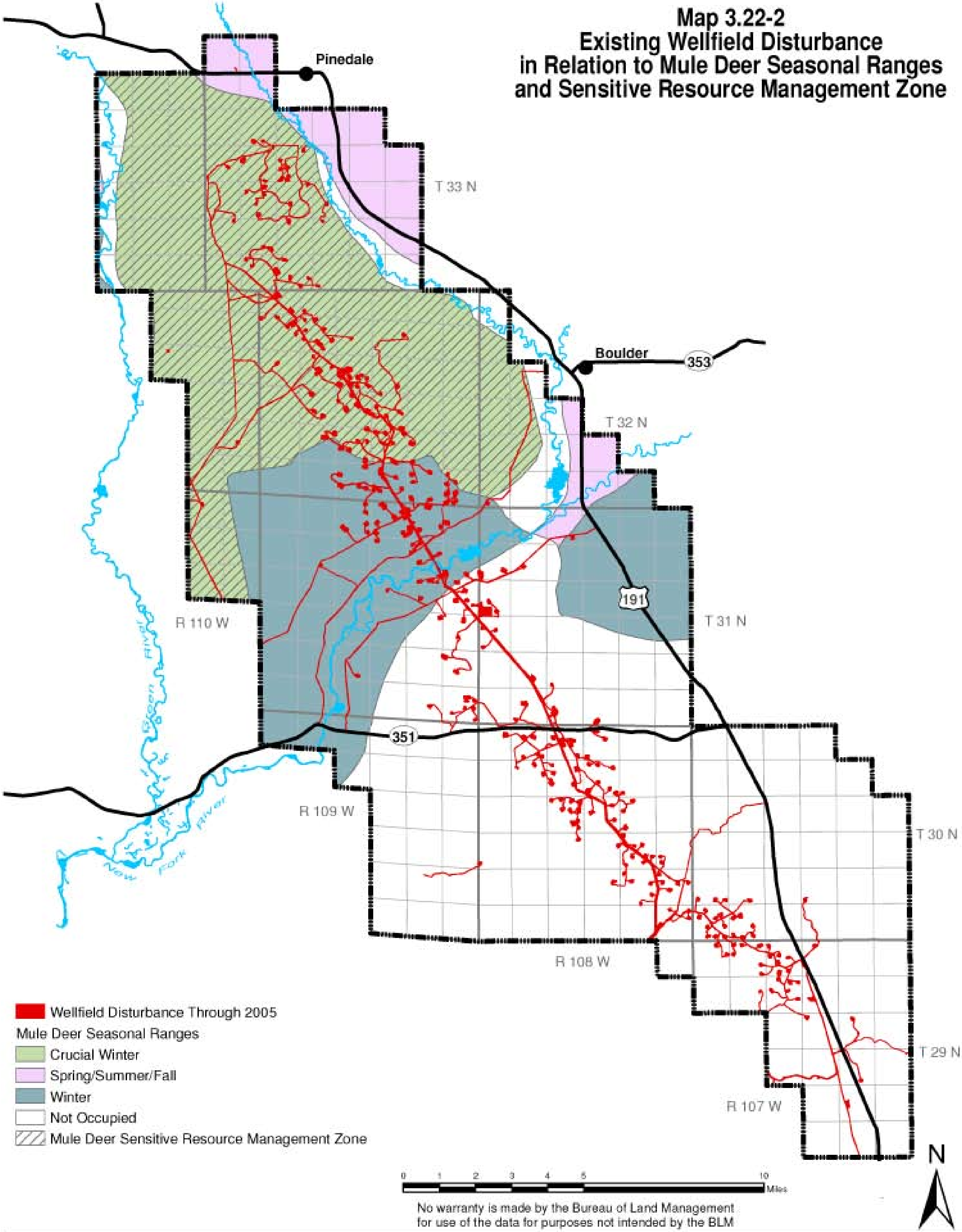
By the end of 2006, 381 additional acres are projected to be disturbed mostly in spring/summer/fall ranges but a relatively larger proportion would be within crucial winter range (Table 3.22-3).

Table 3.22-3
Estimated Existing Wellfield Disturbance in Relation to Pronghorn Seasonal Ranges in the PAPA

Pronghorn Seasonal Ranges	Surface Area in the PAPA (acres)	Surface Disturbance through December 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
Crucial Winter Range and Pronghorn SRMZ	47,590	1,483.4	135.5	1,618.9	3.4
Spring/Summer/Fall Range	150,324	3,195.1	245.4	3,440.5	2.3
Winter Range	120	0.0	0.0	0.0	0.0
Total	**198,034**	**4,678.5**	**380.9**	**5,059.4**	**2.6**

Mule Deer. Much of the PAPA coincides with crucial winter range utilized by mule deer in the Sublette Herd Unit (Map 3-22-2). Mule deer summer in mountainous terrain surrounding the PAPA to the west (Salt River Range and Wyoming Range), north (Snake River Range and Gros Ventre Range), and east (Wind River Range). They migrate to winter ranges in the PAPA and Pinedale Front Complex, traveling up to 60 to 100 miles although a few mule deer appear to be yearlong residents of the Pinedale Mesa (Sawyer and Lindzey, 2001).

Depending on snow conditions, mule deer may begin arriving on winter ranges on the Pinedale Mesa during late October (Sawyer and Lindzey, 2001), later during mild winters. If winter conditions are mild, deer may move northwest, to the vicinity of Cora Butte (Sawyer et al., 2003). Most migratory mule deer wintering on the Pinedale Mesa begin movements back to



Map 3.22-2
Existing Wellfield Disturbance in Relation to Mule Deer Seasonal Ranges and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Mule Deer Seasonal Ranges
Crucial Winter
Spring/Summer/Fall
Winter
Not Occupied
Mule Deer Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
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N

their summer range in late March or early April, depending on weather conditions (Sawyer and Lindzey, 2001).

From 1995 to 2001, the population increased from approximately 27,000 to more than 37,000 then declined to 33,000 animals in 2002, further decreased to 27,000 in 2004 (Clause, 2005a) though increased slightly in 2005 (Table 3.22-4). After winter 1992-1993, the population was at an all-time low and the WGFD eliminated or greatly reduced doe and fawn harvest (harvest of any deer) to accelerate population growth (Smith, 2003). Harvest of all sex and age groups was further reduced from 2003 through 2005 (Clause, 2006a). The estimate of fawns per doe adjusted for harvest (Table 3.22-4) is used to compare fawn production in years with few or no does harvested to production in years with more does harvested (Ayers et al., 2000). Fawn productivity since winter 1992-93 increased through 1997, but has been erratic since then. Productivity declined from 2003 to 2005 (Table 3.22-4).

Table 3.22-4
Mule Deer Sublette Herd Unit Population, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Fawns per Doe Postseason [1]	Fawns per Doe Adjusted for Doe Harvest	Harvest [2]			
				Bucks	Does	Fawns	Total
1999	32,594	0.795	0.794	2,478	23	10	2,511
2000	36,564	0.819	0.810	2,991	226	22	3,239
2001	37,358	0.704	0.694	2,787	372	64	3,223
2002	32,949	0.644	0.618	2,742	817	71	3,630
2003	34,022	0.782	0.769	1,946	305	35	2,286
2004	26,633	0.684	0.672	1,689	302	38	2,029
2005	28,044	0.653	0.649	1,597	172	51	1,820

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

Depressed fawn production observed from 2000-2003 has been attributed to drought conditions (Smith, 2003). For all other big game species discussed in this section, production of young increased in 2004, possibly as a response to improved forage following increased precipitation beginning in winter 2003-2004 (see Table 3.3-1). Mule deer fawn production did not follow the trend but rather declined further in 2004 and continued to decline through 2005 (Table 3.22-4).

The annual precipitation by water year has been approximated for crucial winter ranges in the herd unit (Section 3.3 and Wildlife Technical Report, Appendix K). Annual precipitation from 2000 through 2003 was well below the average precipitation of the previous 30 years. By the time herd composition surveys were conducted in 2001, there had been 2 consecutive years of below-average precipitation (including winter snowfall), 3 consecutive years in 2002, and 4 years of drought in 2003. That trend of low precipitation continued at least through water year 2003.

Over-winter mortality of fawn and adult mule deer in the Sublette Herd Unit has been estimated since 1993 (Wildlife Technical Report, Appendix K). Throughout the period of data collection, adult over-winter mortality rates have been low, ranging from 26 percent mortality (74 percent survival) in winter 2002-2003 to 3 percent mortality (97 percent survival) in winter 1998-1999. Fawn over-winter mortality rates have been higher than adult deer mortality rates in any given year, and significantly higher than adult mortality since winter 2001-2002.

Adult doe mule deer survival in the Sublette Herd Unit has also been monitored by radio telemetry (Sawyer et al., 2003). In general, over-winter survival rates of telemetered adult does have deviated (though not significantly) from survival rates estimated by age ratios (Wildlife Technical Report, Appendix K). Adult mule deer over-winter survival has been consistently above 80 percent survival since that study began in 1999 (Sawyer et al., 2003).

In the PAPA and other winter ranges in the Sublette Herd Unit, over-winter fawn mortality is directly related to total snowfall November through March. Additionally, drought or wet conditions on the winter range during previous two years' growing seasons strongly influence fawn over-winter mortality by ameliorating or exacerbating the influence of winter snowfall (Wildlife Technical Report, Appendix K). For example, a 65 percent fawn mortality rate during winter 2003-2004 was associated with approximately 50 inches of snowfall, totaled from November through March, and only 15 inches of total precipitation during the previous two growing seasons. Approximately 41 inches of snow fell during winter 2004-2005 but there was 21 inches of total precipitation during the 2 years prior. Fawn mortality in winter 2004-2005 was only 31 percent. During winter 2005-2006, fawn mortality in the herd unit was significantly greater than predicted by the relationship of snowfall, precipitation, and temperature observed from winter 1993-1994 through winter 2004-2005. Mortality of fawns on winter ranges along the Pinedale Front was significantly greater than mortality of fawns on winter ranges in the Mesa Complex during 2005-2006, the first year with such a significant difference. Although climatological data do not indicate that winter conditions were more severe on the Pinedale Front than on the Mesa Complex, anecdotal observations made a case for increased winter severity. There are no NWS stations within or proximate to the Pinedale Front Complex to confirm the observations (Wildlife Technical Report, Appendix K).

The Trappers Point Bottleneck, described above for pronghorn, limits migration of mule deer to and from the PAPA (Sawyer and Lindzey, 2001). The bottleneck may contribute to mule deer-vehicle mortality in the 7-mile length of U.S. Highway 191 between Pinedale and Daniel Junction. Available data indicate that many more deer than pronghorns have been killed by vehicles in the 7-mile length of highway (WGFD, 2004d and Carpenter, 2006a). Generally, the proportion of mule deer fawns killed by vehicles is greater than the proportion of fawns in the Sublette Herd Unit. Numbers of mule deer killed by vehicles along U.S. Highway 191 and State Highway 351, reported by WDOT from 1999 through 2005 (Carpenter, 2006a), do not appear to be related to traffic volume on either highway.

Wildlife population growth depends not only on birth and death rates, but also on immigration and emigration of animals into and out of the population. Results of the Sublette Mule Deer Study (Phase II) have shown a consistently declining wintering mule deer population on Mesa crucial winter ranges (Sawyer et al., 2005a). Deer density decreased from 77 deer per square mile in winter 2001-2002 to 41 per square mile in 2004-2005. The density in 2005-2006 was similar to that in the previous winter (Sawyer, 2006). No such trend was observed on crucial winter ranges unaffected by natural gas developments that were used as a control in the study (Pinedale Front Complex). Although the wintering mule deer population on the Pinedale Mesa has declined each year from 2001 to 2005, available information indicates deer are not using alternative habitats, since emigration to other winter ranges is extremely limited. Fewer deer each year may indicate increased mortality of deer that formerly utilized the Mesa, along with minimal recruitment of other deer on the winter range since 2001-2002.

Coincidental with the declining wintering population, use of habitats on the Mesa by wintering mule deer is lowest where well pads have been developed (Sawyer et al., 2004). Areas categorized as high mule deer use prior to development changed to low use as development progressed and areas of low use changed to higher use areas (Sawyer et al., 2005a). This suggests that the natural gas development on the Mesa has displaced mule deer to less suitable habitat. Mule deer have progressively used areas farther away from well pads and development, with the exception of winter 2003-2004, when deep snow may have reduced available habitat options. There were fewer deer on the Mesa in winter 2003-2004 than before 2001, even though winter habitat use patterns by deer were similar during the two periods.

Most of the PAPA (54,242 acres) coincides with mule deer crucial winter range (Table 3.22-5). In the PAPA DEIS (BLM, 1999a), all mule deer crucial winter range defined by WGFD and winter/yearlong range defined by BLM were included in the Mule Deer SRMZ. Since the PAPA DEIS, WGFD reclassified seasonal ranges in the PAPA and the current distribution of crucial winter range is now the Mule Deer SRMZ shown in Map 3.22-2. Most of the surface disturbance associated with wellfield development is within crucial winter range. There were more than 2,000 acres disturbed by wellfield development within mule deer seasonal habitats by the end of December 2005. An additional 229 acres are projected to be disturbed by the end of 2006, a relatively large proportion of which (146 acres) would be within crucial winter range (Table 3.22-5).

Table 3.22-5
Estimated Existing Wellfield Disturbance in Relation to Mule Deer Seasonal Ranges in the PAPA

Mule Deer Seasonal Ranges	Surface Area in the PAPA (acres)	Surface Disturbance through 2005 (acres)	Projected Surface Disturbance in 2006 (acres)	Estimated Existing Surface Disturbance (acres)	Percentage Disturbance
Crucial Winter Range and Mule Deer SRMZ	54,242	1,372.5	146.3	1,518.8	2.8
Spring/Summer/Fall Range	10,396	59.6	0.0	59.6	0.6
Winter Range	35,248	929.6	82.0	1,011.6	2.9
Winter/Yearlong Range	7,320	27.2	0.5	27.7	0.4
Total	**107,206**	**2,388.9**	**228.8**	**2,617.7**	**2.4**

Elk. The PAPA coincides with two elk herd units, the Green River Herd Unit and the Pinedale Elk Herd Unit. The Green River Herd Unit occupies the northernmost portion of the PAPA as non-crucial winter range (1,324 acres) and winter/yearlong range (997 acres). No seasonal ranges in the PAPA are occupied by elk in the Pinedale Herd Unit. No wellfield development has occurred in any seasonal habitats used by elk through 2006. An elk SRMZ was not identified in the PAPA. Each year, WDOT has recorded a few vehicle related mortalities of elk along U.S. Highway 191, primarily north of Daniel Junction and not in the vicinity of the PAPA (Carpenter, 2006a).

Since 2000, calf production in the Green River Herd Unit declined through 2002. Calf production increased in 2004, similarly to pronghorn and moose (below). Calf productivity in the Green River Herd Unit appears lower than in the Pinedale Herd Unit (BLM, 2004a). Harvest of all sex and age groups decreased since 2000, except for bulls, which increased in 2004 (Table 3.22-6).

Long-term trends for elk in the Green River Herd Unit indicate calf production has been significantly declining since the late 1970s. Data for the Pinedale Herd Unit do not reveal such a significant declining trend (BLM, 2004a) and are not included in Table 3.22-6 because occupied portions of the herd unit do not coincide with the PAPA.

Table 3.22-6
Elk Green River Herd Unit Populations, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Calf per Cow Postseason [1]	Calf per Cow Adjusted for Harvest	Harvest [2]				
				Bull	Spike	Cow	Calf	Total
1999	3,855	0.248	0.248	138	24	212	54	428
2000	3,461	0.317	0.315	190	54	345	104	693
2001	3,122	0.302	0.284	157	37	280	45	519
2002	2,544	0.203	0.222	178	17	342	109	646
2003	2,049	0.227	0.225	179	27	260	55	521
2004	2,258	0.281	0.269	217	24	226	44	511
2005	2,506	0.239	0.251	144	31	203	72	450

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006

Wintering elk in both herd units are sustained on feedgrounds that, in part, are maintained to avoid elk conflicts with livestock and private property, especially for elk in the Pinedale Herd Unit (Clause, 2004a). The Scab Creek, Muddy Creek, and Fall Creek feedgrounds in the Pinedale Herd Unit have been established since 1976, and combined, supported approximately 1,747 elk during winter 2005-2006 (Clause, 2006b). Three feedgrounds in the Green River Herd Unit (Black Butte, Green River Lakes, and Soda Lake) supported approximately 2,015 elk during winter 2005-2006 (Clause, 2006c). Elk on all six feedgrounds are vaccinated against brucellosis.

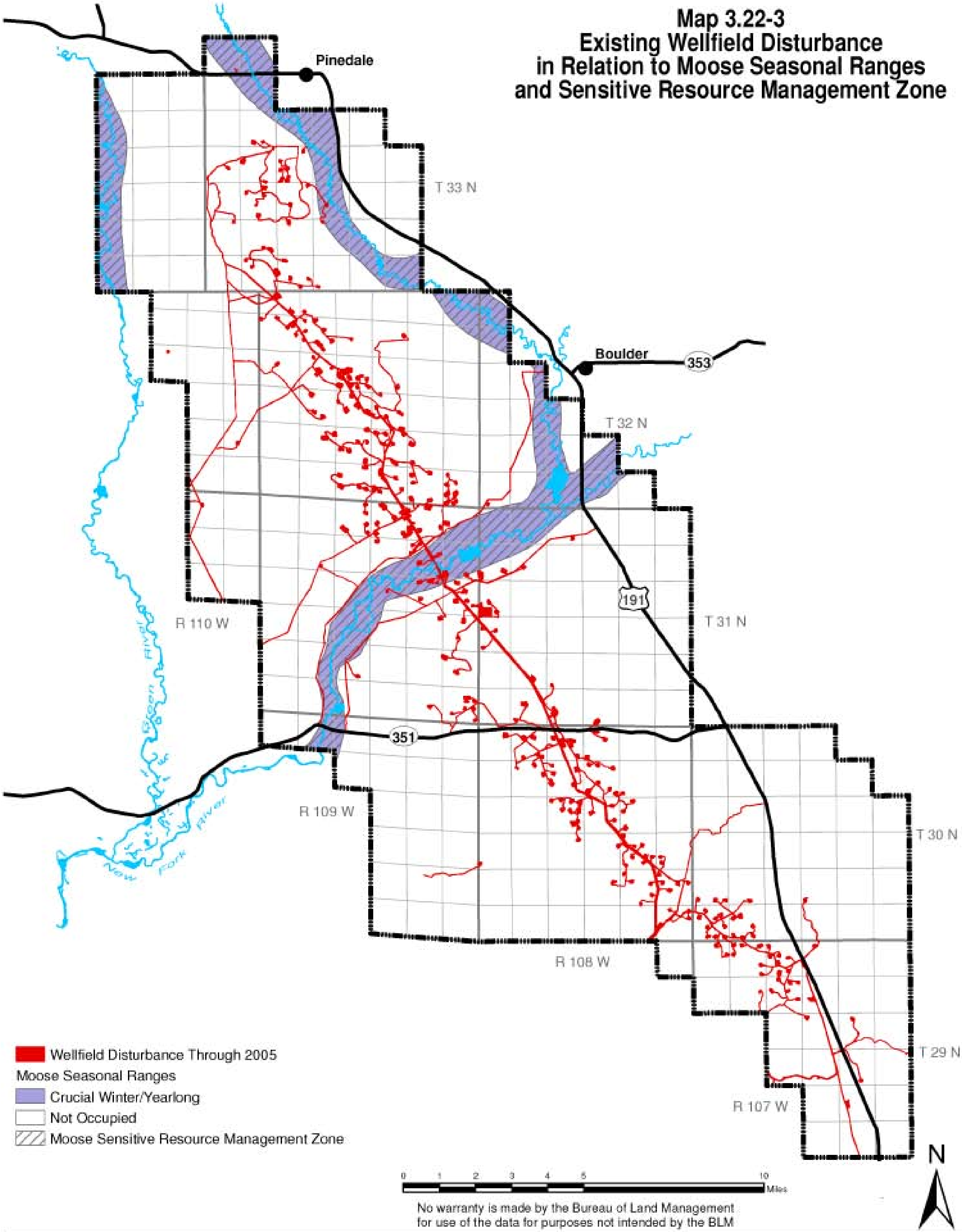
Moose. In the PAPA DEIS (BLM, 1999a), the Moose SRMZ coincided with crucial winter/yearlong moose habitat for the Sublette Herd Unit, found primarily within the riparian zone associated with the New Fork River (Map 3.22-3). Slightly more than 18,000 acres of moose crucial winter/yearlong have been defined within the PAPA. Of that habitat and as of December 2005, 228 acres were disturbed by wellfield development. An additional 24 acres of disturbance is projected for 2006, all within the Moose SRMZ.

The Sublette Herd Unit moose population has declined recently, and the production of calves per cow (adjusted for harvest) has significantly declined from 1994 through 2005 (Table 3.22-7). Similar to pronghorn and elk populations near the PAPA, moose calf production in the herd unit increased in 2004, and 2005 although harvest of bulls, cows, and calves were reduced in both years from harvest levels in 2003. Moose have been killed by vehicles on U.S. Highway 191, near the PAPA, but only occasionally since 1999 (Carpenter, 2006a).

Table 3.22-7
Moose Sublette Herd Unit Populations, Productivity, and Harvest

Year	Postseason Population Estimate [1]	Unadjusted Calf per Cow Postseason [1]	Calf per Cow Adjusted for Harvest	Harvest [2]			
				Bull	Cow	Calf	Total
1999	5,817	0.427	0.405	306	171	21	498
2000	5,967	0.458	0.435	332	172	28	532
2001	5,665	0.344	0.337	352	160	39	551
2002	3,726	0.417	0.406	362	144	35	541
2003	4,028	0.350	0.334	339	161	18	518
2004	4,107	0.412	0.401	258	84	10	352
2005	3,926	0.409	0.400	227	57	5	289

[1] Wyoming Game and Fish Department, Annual Big Game Herd Unit Reports, Jackson/Pinedale Region, 2000-2006
[2] Wyoming Game and Fish Department, Annual Reports of Big and Trophy Game Harvest, 2000-2006


Map 3.22-3
Existing Wellfield Disturbance
in Relation to Moose Seasonal Ranges
and Sensitive Resource Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Moose Seasonal Ranges
Crucial Winter/Yearlong
Not Occupied
Moose Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
N
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3.22.1.2 Upland Game Birds

Greater sage-grouse is the predominant upland game bird in southwestern Wyoming. In 2004, there were 19 active leks within the PAPA (Map 3.22-4). Two leks were abandoned by 2006. There are four additional leks within the PAPA that have been active within the past 10 years and eight leks that are within 2 miles of the PAPA boundary (Map 3.22-4). BLM (2004c) classifies all leks that have been active during at least one strutting season within the past 10 years as "occupied" and subject to the same protection as currently occupied leks.

Adult male greater sage-grouse arrive first on leks, usually by mid-March, thereafter joined by sub-adult males and females (Lyon, 2000). Females move to nest site vicinities several days after copulation (Lyon, 2000). Although reports indicate that most females nest within 2 miles of leks where bred (Braun et al., 1977), some greater sage-grouse hens in the PAPA have nested farther than that. The greatest distance from lek to nest was over 28 miles, observed for one female (Lyon, 2000). Greater sage-grouse hens tend to nest in the same vicinity in consecutive years (Lyon, 2000). In the PAPA DEIS (BLM, 1999a), greater sage-grouse nesting habitat was assumed to include areas within a 2-mile radius around each active and inactive lek, even though distances from leks to nests in the region can be quite variable (Heath et al., 1997 and Lyon, 2000).

The PAPA is within Small and Upland Game Management Area (SUGMA) 3 (Bridger) north of the New Fork River, and in SUGMA 7 (Eden) south of the river. The WGFD has documented harvest data, including total hunters, total recreation-days, and total greater sage-grouse harvested in both SUGMAs since 1982. With data from both areas combined, there have been significant declining trends in numbers of hunters, total hunting recreation-days, and total greater sage-grouse harvested during the past two decades. Of particular importance is the total number of greater sage-grouse harvested per recreation-day, which has significantly declined since 1982, suggesting declining greater sage-grouse (Figure 3.22-1). The decline has occurred even though WGFD has shortened harvest seasons, delayed opening season dates to increase survival of reproductive hens, and decreased bag limits to enhance population growth (Clause, 2006d). Harvest per recreation-day did increase in 2005, possibly reflecting increased survival following precipitation in 2004 and 2005 (see Table 3.3-1) as well as the effects of more conservative harvest management.

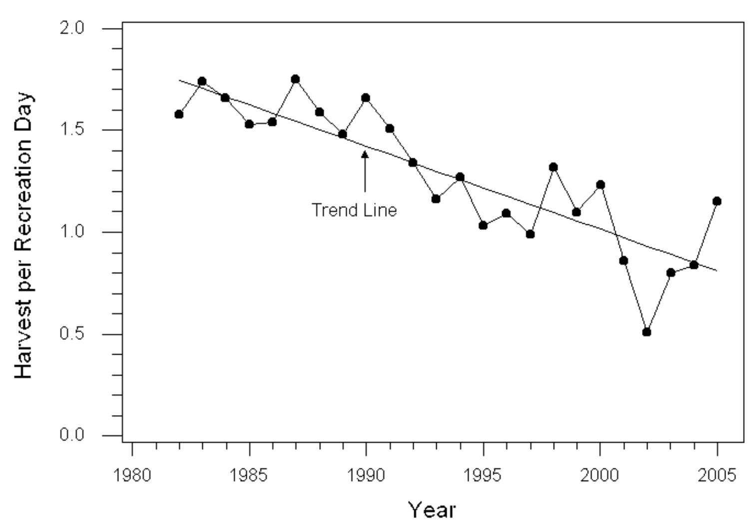
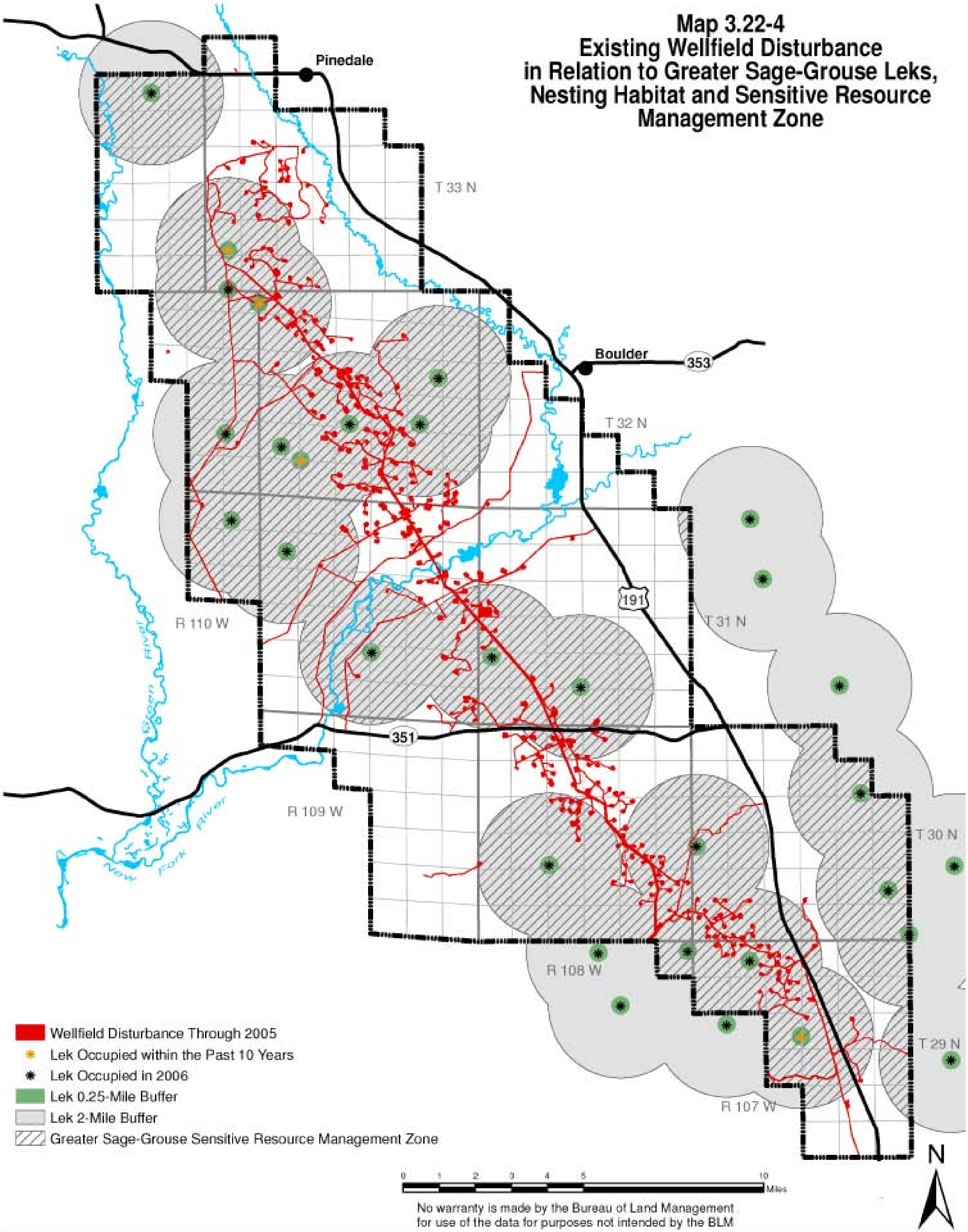


Figure 3.22-1
Greater Sage-Grouse Harvested per Recreation-Day
in SUGMA 3 and 7 Combined, 1982 to 2005.
(Source: WGFD Annual Report of Upland Game and Furbearer Harvest 1983-2006)


Map 3.22-4
Existing Wellfield Disturbance
in Relation to Greater Sage-Grouse Leks,
Nesting Habitat and Sensitive Resource
Management Zone
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Wellfield Disturbance Through 2005
Lek Occupied within the Past 10 Years
Lek Occupied in 2006
Lek 0.25-Mile Buffer
Lek 2-Mile Buffer
Greater Sage-Grouse Sensitive Resource Management Zone
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM
N

Annual census of greater sage-grouse leks has been used to track changes in the breeding population (Connelly et al., 2004), particularly if leks are censused repeatedly within a given year so that the peak in male attendance can be determined (Jenni and Hartzler, 1978). Leks attended by male greater sage-grouse in and near the PAPA were intensively monitored between 1999 and 2004. The investigation indicated that male counts on leks that were heavily impacted by natural gas wells declined 51 percent from 1 year prior to well development through 2004 (Holloran, 2005). For example, on two leks within the PAPA, before development in 2001 average counts on each lek exceeded 15 males but only one male was observed only once on each lek in 2005, and none were seen at either lek in 2006. Generally, there were fewer strutting males on leks closer to drilling rigs than on leks farther away from drilling.

Strutting male numbers decreased with increased traffic volumes within 1.86 miles of the leks and increased noise intensity estimated at leks. The decline has been attributed to displacement of males and low recruitment of yearling males on impacted leks (Holloran, 2005 and Kaiser, 2006).

Since 1999, varying numbers of leks on the Mesa, elsewhere within the PAPA, and within 2 miles of the PAPA have been monitored by personnel with BLM, WGFD, University of Wyoming, and other investigators. A trend emerged as increased numbers of leks were censused. Average male attendance at leks on the Mesa and in the PAPA declined from 2001 through 2004 although average male attendance at leks within 2 miles of the PAPA showed a different trend during the same period (Figure 3.22-2). Average male attendance did increase overall on the Mesa, in the PAPA, and off of the PAPA during 2005 and 2006, possibly due to increased juvenile survival with increased precipitation during 2004 (Figure 3.22-2). Two new leks, one on the Mesa (Lovatt West) and in the PAPA (Dukes Triangle), were found in 2005 and both were active in 2006. During 2006, there were no males observed at two leks on the Mesa (Mesa Springs and Lovatt Draw Reservoir) and, as noted earlier, both leks appear to have been abandoned.

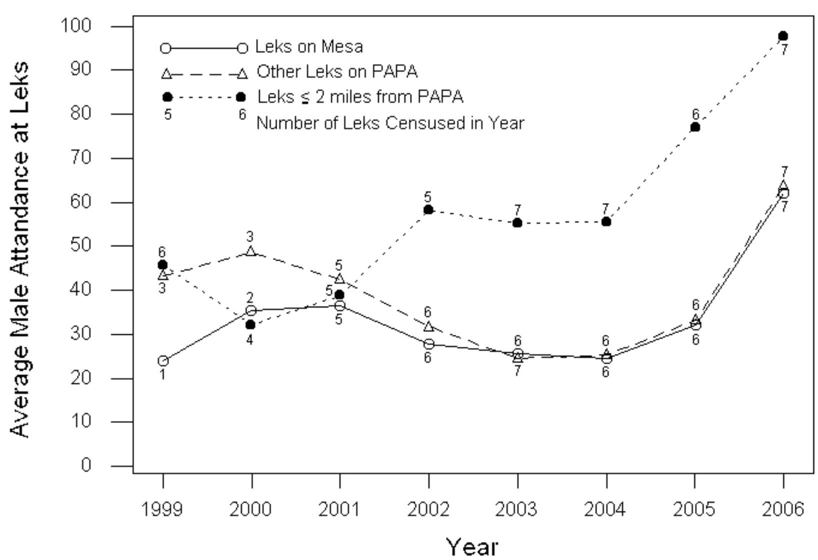


Figure 3.22-2
Greater Sage-Grouse Average Male Attendance at Leks Censused on the Mesa, in the PAPA, and within 2 miles of the PAPA since 1999
(Data from Holloran, 2005; Kaiser, 2006; and WGFD, 2006c).

Mature females are likely to reuse the same nest site. But yearling females select nesting locations farther from haul roads and active drilling rigs, suggesting the long-term response of nesting females is avoidance of development areas (Holloran, 2005).

Greater sage-grouse also winter in the PAPA. Greater sage-grouse movements to winter ranges can take some time and may occur between late August and December. For example, most radio-telemetered greater sage-grouse were in the PAPA and vicinity by November 1998 but arrived later in the PAPA in 1999, possibly due to mild weather that year (Lyon, 2000). Wintering greater sage-grouse depend, in part, on sagebrush extending above the snow and Lyon (2000) documented numerous wintering greater sage-grouse on the Mesa and some within the PAPA south of the New Fork River. Likewise, distributions of greater sage-grouse winter fecal pellet groups surveyed by Wyoming Wildlife Consultants (BLM, 2004c) from 2001 through 2003 indicate wintering grouse are present in the PAPA, north and south of the New Fork River. BLM (2004c) has recommended no disturbance or disruptive activities within greater sage-grouse winter habitat from November 15 through March 14, although wintering habitat in the PAPA has not yet been formally identified.

In the PAPA DEIS (BLM, 1999a), BLM utilized standard stipulations to define and manage important habitat for greater sage-grouse as the Sage Grouse SRMZ, which included all areas within 2 miles of each occupied lek (Map 3.22-4). Specific management components within the SRMZ include avoidance of surface activities or aboveground structures within 0.25 mile of each lek on federal lands and minerals. BLM (2004c) requires avoiding human activity within 0.25 mile of an occupied lek between 8 p.m. and 8 a.m. from March 1 through May 15. Further, BLM requires limiting surface disturbing activities within 2 miles of each lek between March 15 and July 15 to avoid disturbing greater sage-grouse courtship displays on leks and grouse nesting within the 2-mile radius.

WGFD documented locations of 12 leks within the PAPA north of the New Fork River, including the Lovatt West lek (new in 2005), and three occupied leks that were active in the past 10 years. Eleven leks were documented within the PAPA south of the New Fork River, including the Dukes Triangle lek that apparently was first attended by males in 2005 and one other occupied lek that was active in the past 10 years. There are occupied leks within 2 miles of the PAPA border. There are 113,325 acres included in the Sage Grouse SRMZ (Table 3.22-8) which are associated with the 2-mile buffers of all occupied leks.

As of December 2005, there was approximately 42 acres of disturbance within the 0.25-mile buffer for greater sage-grouse leks. There was nearly 3,200 acres of disturbance within the 2-mile buffer and Sage Grouse SRMZ (Table 3.22-8).

Table 3.22-8
Estimated Existing Wellfield
Disturbance to Sage Grouse Lek Buffers in the PAPA

Lek Buffer	Surface Area in the PAPA (acres)	Surface Disturbance through 2005 (acres)	Estimated Additional Surface Disturbance in 2006 (acres)	Estimated Total Existing Surface Disturbance (acres)	Percentage Disturbance
0.25-Mile Buffer	2,831	41.7	2.2	3.9	1.6
2-Mile Buffer and Sage Grouse SRMZ	113,325	3,198.0	249.5	3,447.5	3.0

In 2006, slightly more than 2 acres could potentially be disturbed within the 0.25-mile buffer, but an additional 250 acres of disturbance is projected within 2-mile buffers surrounding leks in the PAPA (the Sage Grouse SRMZ) in 2006 (Table 3.22-8).

Mourning doves are upland game birds potentially harvested in the PAPA, though not to the extent of sage grouse. Ruffed grouse and chuckar may also be hunted in or near the PAPA (Table 3.22-9).

Table 3.22-9
Harvest Data For Other Upland Game Birds and Derived Statistics in SUGMA 3 and 7 During 2005

Game Bird	SUGMA	Hunters	Hunter Days	Harvest	Days per Hunter	Days per Harvest	Harvest per Day
Mourning Dove *Zenaida macroura*	3 - Bridger	11	57	114	5.0	0.5	2.0
	7 - Eden	41	82	218	2.0	0.4	2.7
Ruffed Grouse *Bonasa umbellus*	3 - Bridger	181	860	331	4.7	2.6	0.4
	7 - Eden	17	83	15	5.0	5.6	0.2
Chuckar *Alectoris chuckar*	3 - Bridger	3	5	3	2.0	2.0	0.5
Source: WGFD, 2006d.							

3.22.1.3 Small Game and Furbearing Mammals

Harvest of cottontails and squirrels has been reported in SUGMAs 3 and 7, and both are potentially harvested in the PAPA. Ten species of furbearing mammals may be trapped, snared, or shot near the PAPA although harvest data are not compiled for furbearer species by SUGMA. Furbearers include badger, bobcat, weasel, coyote, raccoon, red fox, skunk, beaver, mink, and muskrat.

Populations of rabbits in North America may be cyclic (Dunn et al., 1982; Chapman et al., 1982). Cottontails harvested per recreational-day in SUGMAs 3 and 7 since 1982 show a 6 to 7- year cycle of peaks. Apparent peaks in 1996 and 2003 were lower than earlier peaks in 1983 and 1990 (Figure 3.22-3), suggestive of an overall population decline at least during peaks. Harvest data from 1982 through 2005 may indicate that cycle intensity may be dampened given that the trend since 1982 has been fewer hunters spending fewer recreational days pursuing cottontails.

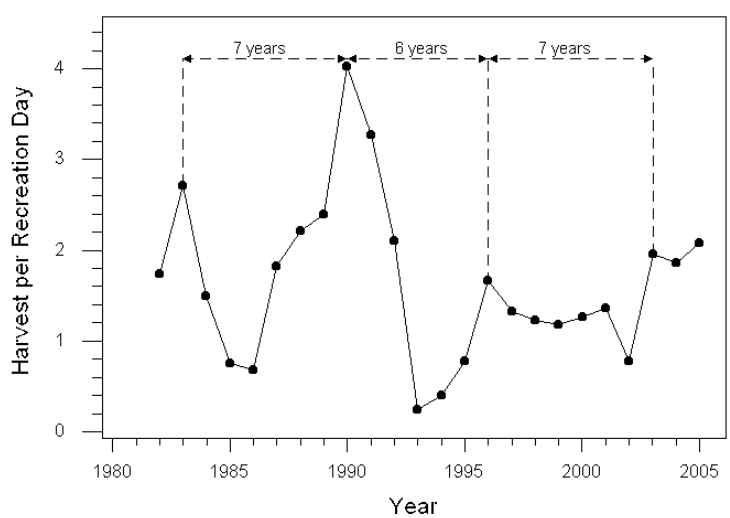


Figure 3.22-3
Cottontail Rabbits Harvested per Recreation-Day in SUGMA 3 and 7 Combined, 1982 to 2005.

3.22.1.4 Migratory Birds

Data compiled for nine National Biological Survey BBS routes in the upper Green River area reveal 150 bird species have been observed on one or more routes since 1980 (Sauer et al., 2005). Of those, 107 species are listed as Nearctic-Neotropical migratory birds by the FWS, Division of Bird Habitat Conservation, pursuant to the Neotropical Migratory Bird Conservation Act.

Not all species on BBS routes are migrants, though, and data for many of the migratory species are sparse, limited to only a few observations some years on a few routes. BBS data for 23 migratory species in the region allowed estimation of trends from 1994 through 2003, reported by the BLM (2004a). With only nine routes in the region, there were only 23 migratory species with barely adequate data to estimate trends over the past 10 years (1994-2003). Those species and their apparent recent trends (past 2 to 3 years) are listed in Table 3.22-10. In 2004, only two of the nine routes were surveyed, an inadequate sample to include in further analysis.

Trends of abundances for six migratory species appear to be declining; of these, four species (killdeer, common nighthawk, rock wren, and sage thrasher) nest on or close to the ground in a variety of habitats. Three declining species inhabit wetland and/or riparian habitats (killdeer, yellow warbler and red-winged blackbird). The abundance of other species that utilize riparian or other moist habitats appear to be increasing (tree swallow, bank swallow, barn swallow, and song sparrow), although those species nest above ground level. Other species that appear to be increasing include western meadowlark, Brewer's blackbird, and brown-headed cowbird; the latter two species have some affinity for human-altered habitats, and western meadowlarks are often associated with agriculture (Cerovski et al., 2004).

Many common raptor species are known to nest, migrate, and seasonally reside, in the vicinity of the PAPA. These include golden eagle, red-tailed hawk, ferruginous hawk, great horned owl, bald eagle, Swainson's hawk, northern harrier, prairie falcon, American kestrel, merlin, osprey, and short-eared owl. Although the common raven occurs in the PAPA, is a potential predator and/or scavenger, and classified as a raptor by some, it is within the same family as jays, magpies, and crows (Corvidae) and not discussed further. Nesting records of golden eagles, ferruginous hawks, short-eared owls, and other raptors, including American kestrel, osprey, great horned owl, northern harrier, prairie falcon, red-tailed hawk, and Swainson's hawk, have been made on or in the immediate vicinity of the PAPA since 2001, and their status in relation to wellfield development has been investigated (Ecosystem Research Group, 2006).

Sharp-shinned hawk, Cooper's hawk, northern goshawk, burrowing owl, and long-eared owl, may also be present in the PAPA during the summer. Birds that may winter in the PAPA include golden eagle, red-tailed hawk, rough-legged hawk, and great horned owl, as well as other less common species (Call, 1978).

Table 3.22-10
Common Neotropical Migratory Birds in the Vicinity of the PAPA with Recent Trends Estimated from National Biological Survey Breeding Bird Survey Data from 1994 to 2003

Common Name Scientific Name	Nest Substrate[1]	General Habitat[1]	Recent Trend
American Kestrel *Falco sparverius*	Tree cavity, abandoned nest	All habitats	No trend
Killdeer *Charadrius vociferus*	Ground	Shoreline, aquatic sites in most habitats	Decreasing
Mourning Dove *Zenaida macroura*	Tree, ground, abandoned nest	All habitats	No trend
Common Nighthawk *Chordeiles minor*	On ground	Open, semi-open habitats, agriculture	Decreasing

Common Name Scientific Name	Nest Substrate[1]	General Habitat[1]	Recent Trend
Horned Lark *Eremophila alpestris*	On ground	Shrubland, grassland	No trend
Tree Swallow *Tachycineta bicolor*	Tree cavity, other cavities	Riparian cottonwood, aspen with cavity trees	Increasing
Violet-green Swallow *Tachycineta thalassina*	Tree cavity, other cavities	Aquatic habitats with cavity trees	No trend
Bank Swallow *Riparia riparia*	Burrow in bank or cliff	Aquatic habitats with cavity banks, cliffs	Increasing
Cliff Swallow *Petrochelidon pyrrhonota*	Attached to natural, man-made structure	Aquatic habitats with substrate for nest	No trend
Barn Swallow *Hirundo rustica*	Attached to natural, man-made structure	Near aquatic habitats with substrate for nest	Increasing
Rock Wren *Salpinctes obsoletus*	In cavity or crevice	Rock outcrops/piles in shrubland, grassland	Decreasing
Mountain Bluebird Sialia currucoides	In cavity in snag	Most habitats with nest cavity tree, snag	No trend
American Robin *Turdus migratorius*	In deciduous or coniferous tree	All habitats with trees, shrubs	No trend
Sage Thrasher *Oreoscoptes montanus*	In or beneath sagebrush shrub	Sagebrush shrubland	Decreasing
Yellow Warbler *Dendroica petechia*	In shrub or small deciduous tree	Riparian shrub, trees	Decreasing
Brewer's Sparrow *Spizella Breweri*	In shrub	Sagebrush shrubland	No trend
Vesper Sparrow *Pooecetes gramineus*	On ground	Shrubland, grassland, agriculture	No trend
Sage Sparrow *Amphispiza belli*	In or beneath sagebrush shrub	Sagebrush shrubland	No trend
Song Sparrow *Melospiza melodia*	In grass clump or in a shrub	Riparian cottonwood, shrub, marsh	Increasing
Red-winged Blackbird *Agelaius phoeniceus*	On emergent vegetation	Riparian shrub, marsh, agriculture	Decreasing
Western Meadowlark *Sturnella neglecta*	On ground	Shrubland, grassland, agriculture	Increasing
Brewer's Blackbird *Euphagus cyanocephalus*	Tree or shrub just above ground	Deciduous forest, shrub, grass, urban	Increasing
Brown-headed Cowbird *Molothrus ater*	Parasitizes nests of other birds	Riparian cottonwood, shrub, agriculture, urban	Increasing

[1] Abbreviated from descriptions by Cerovski et al., 2004.

3.22.1.5 Nongame Wildlife Species

Nongame mammals, birds, and herpetofauna that were likely to have inhabited the PAPA when the PAPA DEIS was issued (BLM, 1999a) are not likely to have changed since then.

3.22.1.6 Aquatic Resources

Aquatic resources in the PAPA were described in Section 3.20 of the PAPA DEIS (BLM, 1999a). The Green River and New Fork River provide habitats for several game fish species. Since 2000, WGFD surveyed in the Green River downstream and upstream from the confluence of the New Fork River and within the New Fork River, downstream of the confluence with the East Fork River and upstream to Pine Creek. The results of those investigations have been summarized in WGFD's Annual Fisheries Progress Reports, Jackson/Pinedale Region.

Sampling to estimate populations of game fish in the various river segments has been conducted in some years (Table 3.22-11). Though sample sizes for some species have been too small to allow population estimates, the values in Table 3.22-11 probably represent relative population sizes. Brown trout consistently appear to be most abundant in each of the river segments near the PAPA. Rainbow trout have generally been the next most abundant game fish, although abundance of Snake River cutthroat trout in the Green River, downstream of the confluence with the New Fork River, appeared to exceed rainbow trout in 2002.

Table 3.22.11
Population Estimates of Game Fish Species in
River Segments of the Green River and New Fork River Proximate to the PAPA

River Segment	Common Name Scientific Name	Estimate of Fish > 6 inches per mile in River Segment [1]			
		2001	**2002**	**2003**	**2004**
Green River Downstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	18	24	Ns	ns
	Brown Trout *Salmo trutta*	197	616	Ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	22	11	Ns	ns
Green River Upstream from New Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	ns	ss (1)	-
	Brown Trout *Salmo trutta*	ns	ns	ss (150)	349
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	ns	ss (8)	164
	Mountain Whitefish *Prosopium williamsoni*	ns	ns	928	-
	Brook Trout *Salvelinus fontinalis*	ns	ns	-	12
New Fork River Downstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ss (2)	ns	Ns	ns
	Brown Trout *Salmo trutta*	302	ns	Ns	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	5	ns	Ns	ns
	Kokanee Salmon *Oncorhunchus nerka*	ss (≥3)	ns	Ns	ns
	Lake Trout *Salvelinus namaycush*	ss (1)	ns	Ns	ns
New Fork River Upstream from East Fork Confluence	Snake River Cutthroat Trout *Oncorhynchus clarki behnkei*	ns	2	≈3	ns
	Brown Trout *Salmo trutta*	ns	507	973	ns
	Rainbow Trout *Oncorhunchus mykiss gairdneri*	ns	16	≈71	ns
	Kokanee Salmon *Oncorhunchus nerka*	ns	-	≈6	ns

[1] ss = sample too small for population estimate, followed by numbers of individuals observed, in parenthesis. ; ns = not sampled.
Source: WGFD, 2002b, 2003b, 2004e, 2005b, and 2006d.

Rainbow trout have been declining in the Green River since stocking was discontinued prior to 2000. The abundance of mountain whitefish in the Green River, upstream of the confluence with the New Fork River, was greater than for all trout species in 2003 (Table 3.22-11). Other, less abundant, game species include kokanee salmon, brook trout, and lake trout.

In 2001, the abundance of rainbow trout and Snake River cutthroat trout in the segment of the New Fork River that flows through the PAPA had declined relative to previous years. Conversely, the abundance of brown trout had increased in 2001. While rainbow and Snake River cutthroat trout spawn in the spring, brown trout are fall spawners (Baxter and Stone, 1995). Declines of rainbow and Snake River cutthroat trout in the New Fork River may be related to the increase of brown trout. Drought conditions through 2003 may have influenced the population of some game fish. The parasitic infection, whirling disease, was first documented in the New Fork River in 1998. Brown trout and mountain whitefish were sampled in the New Fork River during 2003 but tested negative, and the extent of the disease among game fish has not been determined.

Surveys for native non-game fish in the Green River drainage began in 2003 with primary emphasis on the status and distribution of the bluehead sucker, flannelmouth sucker, and roundtail chub (WGFD, 2006e). So far, only the flannelmouth sucker has been found in the Green River but none of the three species - bluehead sucker, flannelmouth sucker, and roundtail chub - has been documented in the New Fork River or its tributaries near the PAPA. Bluehead suckers and roundtail chubs have been found downstream of the PAPA, including the Big and Little Sandy rivers and Blacks Fork drainage. Other native non-game species have been collected in the Green River, upstream and downstream of the confluence with the New Fork River (Table 3.22-12). Though native to Wyoming, white suckers are not native to the Green River drainage and have hybridized with native flannelmouth suckers. Indeed, hybridization by non-native species is one threat to native species in the Green River drainage.

Table 3.22-12
Native, Non-Game Fish Documented in
River Segments of the Green River Proximate to the PAPA.

Common Name Scientific Name	Segment from Confluence with New Fork River: Downstream	Segment from Confluence with New Fork River: Upstream
Mountain Sucker *Catostomus platyrhynchus*	present 2002	present 2003
Flannelmouth Sucker Catostomus latipinnis	present 2002	present 2003
White Sucker *Catostomus commersoni*	present 2002	present 2003
Flannelmouth x White Sucker hybrid	-	present 2003
Redside Shiner *Richardsonius balteatus*	present 2002	present 2003
Speckled Dace *Rhinichthys osculus*	present 2002	present 2003
Utah Chub *Gila atraria*	present 2002	-
Fathead Minnow *Pimephales promelas*	present 2002	-
Mottled Sculpin *Cottus bairdi*	present 2002	present 2003
Source: WGFD, 2003c, and 2004e.		

The condition of the riparian component of aquatic habitat along the New Fork River is a concern. Big game browsing appears to limit recruitment of mature riparian trees, principally willows and cottonwoods (WGFD, 2003b). Riparian trees provide shade, instream detritus, and streambank stability, all of which are important to sustain aquatic resources.

3.22.2 Pipeline Corridors and Gas Sales Pipelines

Wildlife species known to occur in lands crossed by the proposed corridor/pipeline alignments include a variety of common mammals, wild horses, aquatic species, and migratory birds common to sagebrush-steppe, grassland, and wetland riparian community types, similar to wildlife that occur in the PAPA.

Pronghorn habitat for the Sublette and Carter Lease herds is crossed by the existing pipeline corridors, as well as the proposed corridor/pipeline alignments. The proposed corridor/pipeline alignments would cross crucial winter, crucial severe winter relief, spring/summer/fall, and year-long ranges of the Sublette and Carter Lease herds north and south of the Green River and at the southern terminus near Granger, respectively (Frost, 2006 and Lockwood, 2006). The proposed corridor/pipeline alignments would cross yearlong, winter/yearlong, and winter ranges for mule deer (Fralick, 2005). Approximately 2 miles of elk severe winter relief area would be crossed on the south side of the Green River, within the BFGC and the OPC. Approximately 1 mile of moose winter/yearlong and approximately 2 miles of moose yearlong habitat would be crossed by the proposed corridor/pipeline alignments. Habitats within the proposed corridors are not known to support populations of elk and moose, although, individuals are infrequently observed in the vicinity of the proposed corridors (Fralick, 2005).

Greater sage-grouse leks, within and near the existing pipeline rights-of-way and proposed corridor/pipeline alignments have been identified by the BLM. Five greater sage grouse leks have been identified within 2 miles of the proposed corridor/pipeline alignments in Sublette County.

Sagebrush steppe habitats along the proposed corridor/pipeline alignments are known to support several migratory and non-migratory bird species. These species include ferruginous hawk, Swainson's hawk, golden eagle, mountain plover, greater sage-grouse, mountain plover, Brewer's sparrow, sage sparrow, McCown's longspur, loggerhead shrike, and the lark bunting.

Grasslands and short-grass prairie habitat types are very limited along the proposed corridor/pipeline alignments and are primarily restricted to road-side ditches and areas of grazing or past disturbance where encroachment by shrubs has not occurred. This habitat type supports several migratory bird species, such as long-billed curlew, Brewer's sparrow, lark bunting, McCown's longspur, short-eared owl, burrowing owl, upland sandpiper, mountain plover, golden eagle, ferruginous hawk, and Swainson's hawk. Due to the limited expression of this habitat type, migratory bird species that are grassland obligates are not likely to be present along the corridor/pipeline alignments.

Wetland and riparian habitats are very limited within the proposed corridor/pipeline alignments. Emergent wetland vegetation is present along the river banks of the Blacks Fork and Green rivers. Riparian habitats are not present at the proposed crossing locations of these rivers. The proposed crossing location of the New Fork River supports emergent wetlands within the flood plain as well as forested riparian habitat adjacent to the proposed corridor/pipeline alignments. This habitat type may support a number of avian species near the proposed corridor/pipeline alignments, such as red-tailed hawk, osprey, and bald eagle.

The Little Colorado Desert Wild Horse Herd Management area overlaps with approximately 23 miles of the proposed corridor/pipeline alignments. These horses are managed as an important part of the natural system under the multiple-use concept since 1971, when the Wild Free-Roaming Horses and Burro Act of 1971 was passed (Dunder, 2006).

The Green River, Blacks Fork River, and New Fork River are all known to support fisheries. The Green River below the Fontenelle Dam supports brown, rainbow, and cutthroat trout. Kokanee salmon spawn in October downstream of the Fontenelle Dam. The Green River is classified as a Class 2 trout fishery, which is a fishery of statewide importance. The Blacks Fork is classified as a Class 4 trout fishery. It is a fishery of local importance, but normally incapable of supporting pressure from substantial fishing (WGFD, 1991a). The New Fork River supports both rainbow and brown trout.

3.23 HAZARDOUS MATERIALS

Hazardous materials that would be present in the PAPA include those used and produced in association with natural gas drilling, completion, and production. Those substances and their current management protocol are discussed in detail in the Hazardous Materials Management Summary (Appendix C).

Chapter 4
Environmental Consequences

4.1 INTRODUCTION

The PAPA DEIS (BLM, 1999a) was released for public review and comment in 1999. The existing environment in 1999 was very different from the one present in 2006 and described in Chapter 3 of this Draft SEIS. In 1999, much was unknown about the future of natural gas development in the PAPA. Consequently, impacts described in the PAPA DEIS were generic and the document recognized that level and significance of actual impact to each resource would depend on the level of development, as it would ultimately progress in the future.

Of necessity, environmental impacts disclosed in the PAPA DEIS (BLM, 1999a) were based on assumptions associated with the anticipated levels of development. Some effects to various resources by natural gas development in the PAPA are now known, at least for the level of development that has evolved since the PAPA ROD (BLM, 2000b) was issued in July 2000. Documentation of the effects is incorporated into the appropriate sections of Chapter 3 and when applicable, known effects are addressed in this chapter.

The alternatives for future development in the PAPA considered in this Draft SEIS are quantitatively and qualitatively different from the alternatives analyzed in the PAPA DEIS (BLM, 1999a). In 1999, three exploration and development scenarios were incorporated within each of three alternatives, which at that time were titled "Mitigation Alternatives." The three exploration and development scenarios were developed to address the uncertainty of the future spatial (geographic) distribution and intensity of natural gas development. The exploration and development scenarios in the PAPA DEIS are as follows:

1. The *Project Wide Exploration/Development Scenario* assumed that development would generally occur throughout the entire PAPA. Two potential levels of development were analyzed; 500 and 700 producing well pads. The scenario assumed that to reach the 700 well pad development level, 900 well pads would be constructed and drilled and that 200 of the well pads would be reclaimed because the wells would be non-productive, dry holes. Similarly, it was assumed that 650 well pads would be constructed to achieve the 500 producing well pad development level (150 well pads would be reclaimed).
2. The *Anticline Crest Exploration/Development Scenario* assumed that approximately 70 percent of the well pads would be located within 1 mile of the Anticline Crest and 30 percent of the well pads would be located in the three hot spots away from the Anticline Crest. An equal number of well pads would be developed in each hot spot. The two potential levels of development (500 and 700 producing well pads) as discussed above were evaluated under this scenario for each of the alternatives described below.
3. The *No Action Exploration/Development Scenario,* required by CEQ guidelines, was included to describe the impacts of no further development in the PAPA while recognizing that BLM could not impose the scenario because federal minerals were leased and BLM made the commitment to allow development of natural gas. The No Action scenario provided a benchmark against which to compare the impacts of the other anticipated levels of development.

The three exploration/development scenarios were analyzed within the framework of three "Mitigation Alternatives," constructed to incorporate different levels of mitigation requirements across the landscape during future implementation of one scenario or another. The three alternatives analyzed in the PAPA DEIS (BLM, 1999a) are:

- The *Standard Stipulations Alternative* assumed that either 500 or 700 producing well pads would be developed entirely under BLM's Standard Mitigation Guidelines (Appendix A of the DEIS) and lease stipulations. Impact analysis was based on an average of up to eight drilling rigs operating within the PAPA year-round. Unless required by lease stipulations, the *Standard Stipulations Alternative* generally did not limit the density of development (the number of potential well pad locations per section) within any of the SRMZs. In most cases, the alternative addressed impact from locating up to 16 well pads per section in each of the SRMZs.
- The *Resource Protection (RP) Alternative on Federal Lands and Minerals* analyzed the impacts of implementing the RP Alternative on only federal lands and minerals. This alternative assumed that either 500 or 700 producing well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. It disclosed the types of impacts that would remain even if BLM implemented additional controls to reduce undue impacts. It evaluated the benefits of slower paced development by limiting the number of rigs operating annually in the PAPA to five. This RP Alternative considered pad drilling as an option for reducing surface disturbance and human presence in the PAPA. Pad drilling refers to the practice of directionally drilling multiple wells, each with different bottom-hole locations, from a single well pad. The RP Alternative included the use of centralized production facilities to reduce storage of condensate and produced water on each well pad, collecting them at central locations for removal, thereby reducing truck traffic needed for liquids removal.
- The *Resource Protection (RP) Alternative on All Lands and Minerals* analyzed the impacts of implementing the RP Alternative throughout the PAPA (on all lands and minerals). This alternative assumed that either 500 or 700 producing well pads would be developed using BLM's Standard Mitigation Guidelines and lease stipulations. This alternative evaluated implementation of mitigation measures (pad drilling and centralized production facilities) on all lands and minerals. However, the alternative recognized that adoption of the additional mitigation measures on private and state lands and minerals would be strictly voluntary by operators and probably would not occur.

The PAPA ROD (BLM, 2000b) ultimately authorized the *Resource Protection Alternative on Federal Lands and Minerals* with expected implementation of the *Project Wide Exploration/Development Scenario* because it would include all of the PAPA and would be less restrictive should future exploration warrant development beyond the Anticline Crest. As analyzed in the PAPA DEIS (BLM, 1999a), the *Resource Protection Alternative on Federal Lands and Minerals* would have limited the pace of development by allowing no more than five drilling rigs operating in the PAPA at any one time. Only two drilling rigs on new locations north of the New Fork River would have been allowed on federal lands and minerals. This limitation was not carried forward in the PAPA ROD (see PAPA ROD: Management Considerations, page 36) using the following rationale:

> *"BLM has concluded that to limit the number of rigs working in the PAPA at any one time (on Federal and non-Federal lands and minerals combined) would be extremely difficult administratively. However of greater consequence and importance is the fact that the Operators are already seasonally restricted over a significant portion of the PAPA, leaving a relatively small window within which to complete field development activities*

> *(i.e., May 1 through July 1 restriction in many areas due to sage grouse nesting, mountain plover nesting, bald eagle nesting; July 1 through November 15 no restriction). The EIS proposed action and analysis inherently provides for a control on the pace of development. Many factors enter into this including availability of rigs, availability of workers, market price of natural gas, budgetary constraints, etc. Therefore, the BLM will place no restrictions on the number of rigs drilling within the PAPA at any one time. The Operator must be able to take advantage of the drilling window available."*

4.1.1 Impact Analysis Related to the PAPA DEIS

The brief synopsis, above, of the three alternatives analyzed in the PAPA DEIS (BLM, 1999a), emphasizes the uncertainty of the anticipated future intensity and spatial (geographic) extent of natural gas development in the PAPA at the time. As BLM explained in the PAPA DEIS:

> *"At this point in time, insufficient information is available to understand exactly how the Pinedale Anticline should ultimately be developed (i.e., it is not currently possible to predict where the actual productive zones are located and what well density will be necessary to drain the reservoir(s) or adequately estimate ultimate production). However, the operators believe that at least 8 and as many as 16 bottom holes per section may be required to adequately drain productive zones which may be discovered in the future……Because so little of the PAPA has been explored and much remains to be understood about the ability of the anticline to economically produce natural gas, the operators have been unable to develop a detailed proposed action that specifies locations of wells and associated facilities (e.g., roads, gathering pipelines, etc.). The lack of available information to quantify development potential requires this EIS to consider a wide range of exploration/development scenarios and potential levels of development. This range includes considering the impacts from wide spread development across the full extent of the PAPA to no further additional exploration or development."*

Even with that acknowledgement, there were assumptions specified in the PAPA DEIS (BLM, 1999a) that were applied to impact evaluations in the document, particularly evaluations of surface disturbance related to future wellfield development. The assumptions, included in Table 4.1-1, are the maximum of any analyzed in the PAPA DEIS. They were developed in the *700 Productive Well Pad Level of Development Scenario* under the *Standard Stipulations Alternative*. Assumptions applicable to surface disturbance analyzed for each of the RP Alternatives would have resulted in less short-term and long-term disturbance than for the *Standard Stipulations Alternative* in Table 4.1-1.

Over the 10 to 15 year period of development anticipated in the PAPA DEIS (BLM, 1999a), the wellfield components identified in Table 4.1-1 would have disturbed a total of 6,153 acres in the short-term (initial disturbance) and 1,909 acres in the long-term (LOP) under the *Standard Stipulations Alternative*.

Although such disturbance is not static, a best estimate for total wellfield disturbance since the PAPA ROD (BLM, 2000b) was issued is 4,118 acres through 2005. The Operators provided development plans for 2006 and this projected disturbance totals 381 acres. That total of 4,499 acres is in addition to 561 acres that had already been disturbed prior to July 2000. Some of the surface disturbance, before and after issuance of the PAPA ROD, has been revegetated, particularly within pipeline corridors, but the amount of reclaimed disturbance changes constantly as new pipelines are placed in existing, revegetated corridors or as roads and well pads are expanded.

Compared to the maximum surface disturbance estimate of 6,153 acres short-term and 1,909 acres long-term over 10 to 15 years of development analyzed in the PAPA DEIS (BLM, 1999a), the total amount disturbed by wellfield development is 4,499 acres within the 6 years following issuance of the PAPA ROD (BLM, 2000b). Although the total disturbance has not exceeded the disturbance analyzed in the PAPA DEIS (BLM, 1999a), the pace of development has exceeded the pace of development analyzed in the PAPA DEIS.

Table 4.1-1
Assumptions Utilized in the PAPA DEIS for Analyzing Impact[1]

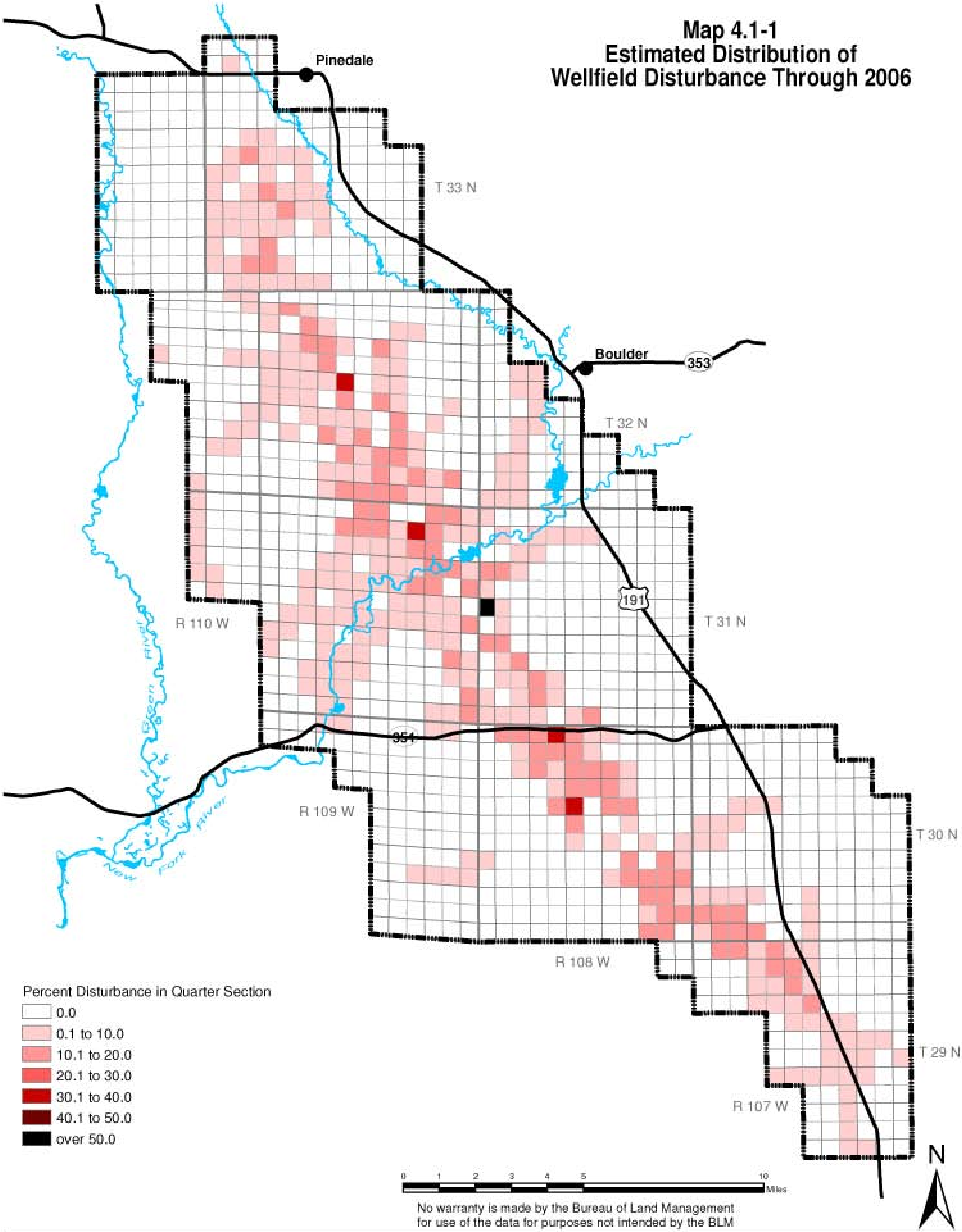
Wellfield Component	Maximum Number For Any Alternative	Short-Term Disturbance per Unit	Long-Term Disturbance per Unit	Maximum Short-Term Disturbance Analyzed	Maximum Long-Term Disturbance Analyzed
Period of Development	10 to 15 years	N/A	N/A	N/A	N/A
Number of Wells Drilled	60 to 90 wells/year	N/A	N/A	N/A	N/A
Number of Rigs Operating at a Time	average of 8 rigs, year-round	N/A	N/A	N/A	N/A
Producing Well Pads	700 pads	3.7 acres/well	1.5 acres/well	2,590 acres	1,050 acres
Dry Hole Well Pads[2]	200 pads	3.7 acres/well	0 acres/ well	740 acres	0 acres
Collector Roads	6 miles	6.3 acres/mile	4.4 acres/mile	38 acres	26 acres
Local and Resource Roads with Adjacent Gathering Pipelines	280 miles	8.5 acres/mile	2.9 acres/mile	2,380 acres	812 acres
Resource Roads to Dry Holes	80 miles	4.8 acres/mile	0 acres/mile	384 acres	0 acres
Compressor Sites	3 sites	7 acres/site	7 acres/site	21 acres	21 acres
			TOTAL	**6,153 acres**	**1,909 acres**

[1] Impact analysis for implementation of the 700 Productive Well Pad Level of Development Scenario under the Standard Stipulations Alternative.
[2] As of December 2005, 266 well pads were constructed since the issuance of the PAPA ROD and five of those contained a single non-producing well.

4.1.2 Spatial Analysis of Future Surface Disturbance

The inventory of wellfield disturbance through 2005 and the Operators' projections for 2006 form the baseline for all future natural gas development in the PAPA for all alternatives. The Operators provided their plans for both 2006 and for future long-term development in the PAPA; however, specific locations were not provided. To allow for spatial analysis, a model was developed to estimate the surface disturbance in each quarter section in 2006 and into the future for development under the No Action Alternative and the Proposed Action Alternative. A description of the distribution model is provided in Appendix L. Development information provided by the Operators for the Proposed Action Alternative was used to model disturbance for Alternative C through 2023. Although the geographic distribution of initial ground-disturbing actions might change, the amount of disturbance and general area of initial disturbance are assumed to be representative of long-term development.

The spatial (geographic) distribution and density of all existing wellfield disturbance is shown on Map 4.1-1, which is based on all development seen on the ground in satellite imagery for 2005 and new development projected by the Operators in 2006. The map displays the distribution and density of wellfield development through 2006 as a percentage of the area (within each quarter section) that is disturbed. The areas of initial surface disturbance have not been adjusted for reclamation efforts because it is impossible to predict when and where reclamation would occur over the landscape by the end of 2006. Likewise, there have been no attempts to


Map 4.1-1
Estimated Distribution of
Wellfield Disturbance Through 2006
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Percent Disturbance in Quarter Section
0.0
0.1 to 10.0
10.1 to 20.0
20.1 to 30.0
30.1 to 40.0
40.1 to 50.0
over 50.0
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

model how reclamation would offset initial wellfield surface disturbance in the future for each of the alternatives analyzed, below. The future distribution of wellfield development by any alternative is uncertain and therefore, differences should not be viewed as absolute. The Proposed Action Alternative and Alternative C through 2011 have more disturbance than the No Action Alternative. This is because winter restrictions would not apply in certain areas under the Proposed Action Alternative and Alternative C, essentially increasing the pace of development over the No Action Alternative. Distribution of surface disturbance between all alternatives through 2011 would be different; however, the distribution of surface disturbance for the Proposed Action Alternative and Alternative C through 2023 would be similar.

4.1.2.1 Alternative A (No Action Alternative)

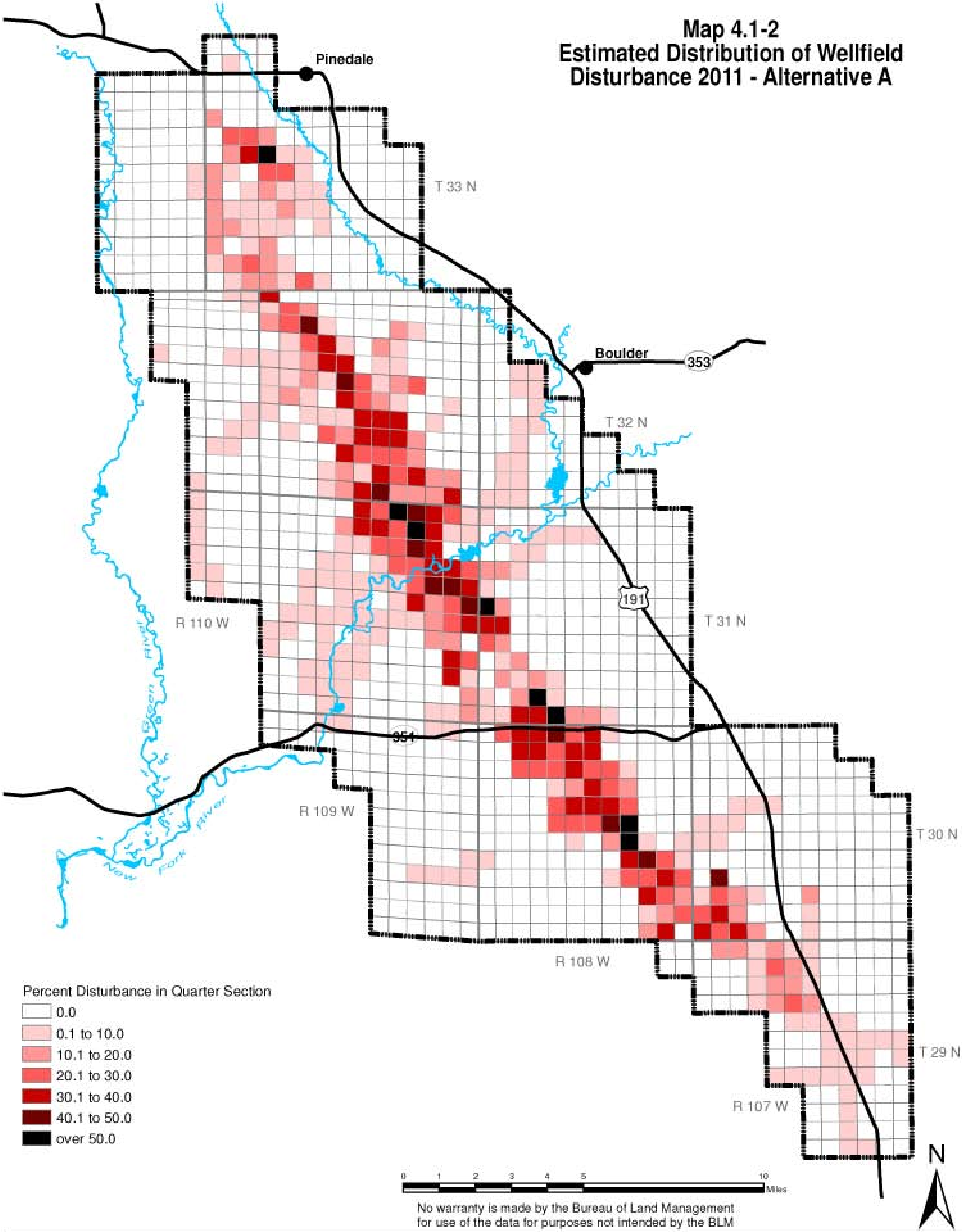
A projected distribution at the end of 2011 of one possible outcome of development under the No Action Alternative is shown on Map 4.1-2. Future wellfield development under the No Action Alternative would follow guidance in the PAPA ROD (BLM, 2000b). Specifically, numbers of new well pads projected by each Operator within each MA would be limited by the MA thresholds for total producing well pads established in the PAPA ROD. It is projected that the threshold of 212 producing well pads in MA 5 would be reached in 2009. The estimated distribution and density of wellfield disturbance accounting for the threshold is shown on Map 4.1-2. The distribution of disturbance includes disturbance as a result of new well pads, access roads to newly constructed well pads, gas gathering pipelines to new well pads, additional liquids gathering pipelines (to connect existing liquids gathering pipelines), and all trunk pipelines and ancillary facilities identified in Table 2.4-5.

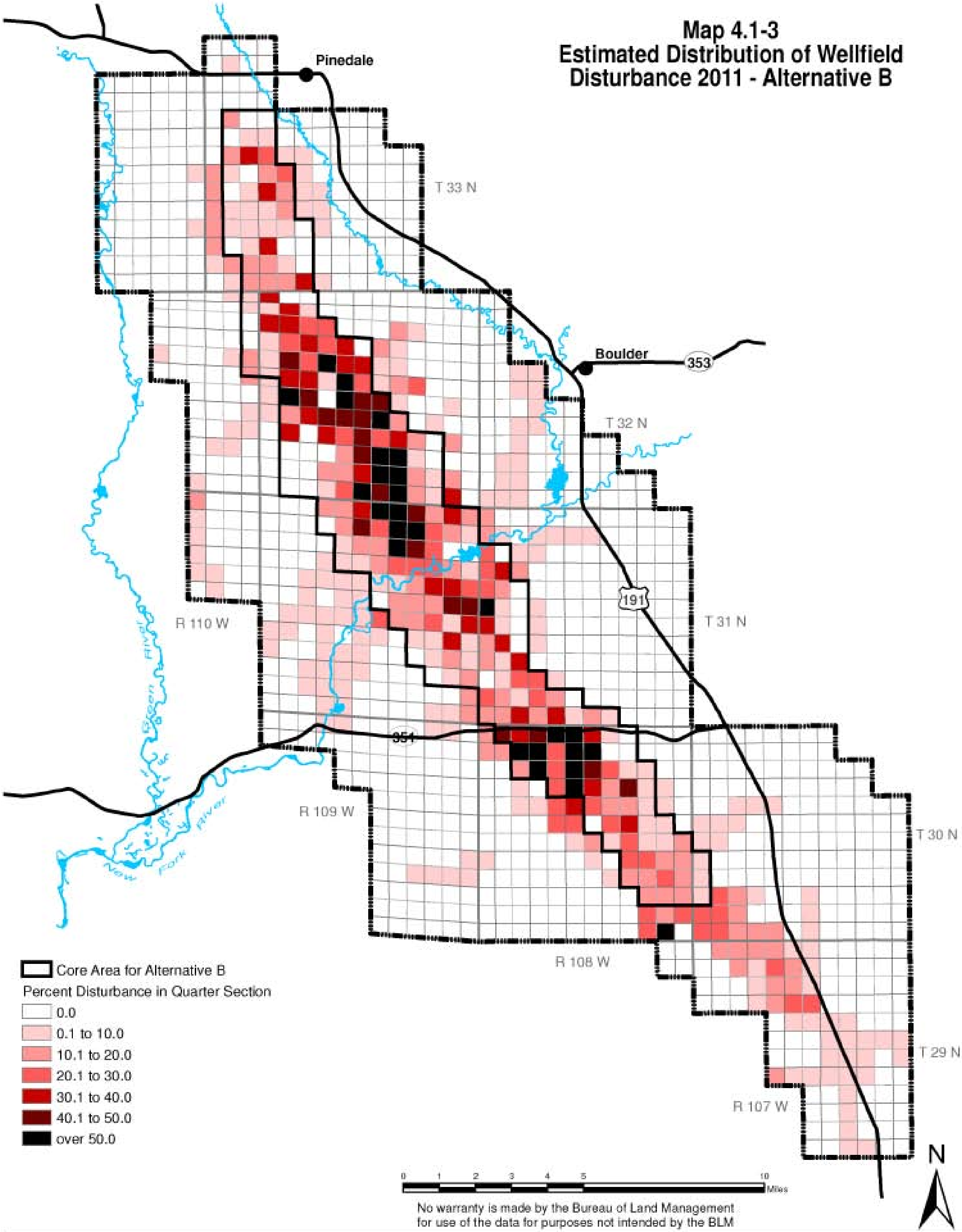
4.1.2.2 Alternative B (Proposed Action)

One possible scenario of distribution and density of wellfield disturbance at the end of 2011 under the Proposed Action Alternative is shown on Map 4.1-3. The Operators specified general locations of new and expanded well pads for years 2007 through 2011. Under the Proposed Action Alternative, year-round drilling would occur within each of three CDAs (see Chapter 2). The distribution of disturbance through 2011 and 2023, shown on Maps 4.1-3 and 4.1-4, respectively, includes newly constructed well pads, expansion of existing well pads, access roads to newly constructed well pads, and natural gas gathering pipelines to new well pads. Under this alternative, the distribution of disturbance includes the liquids gathering system proposed for the central and southern portions of the PAPA, and all pipelines and ancillary facilities identified in Table 2.4-8 (through 2011) and Table 2.4-9 (through 2023).

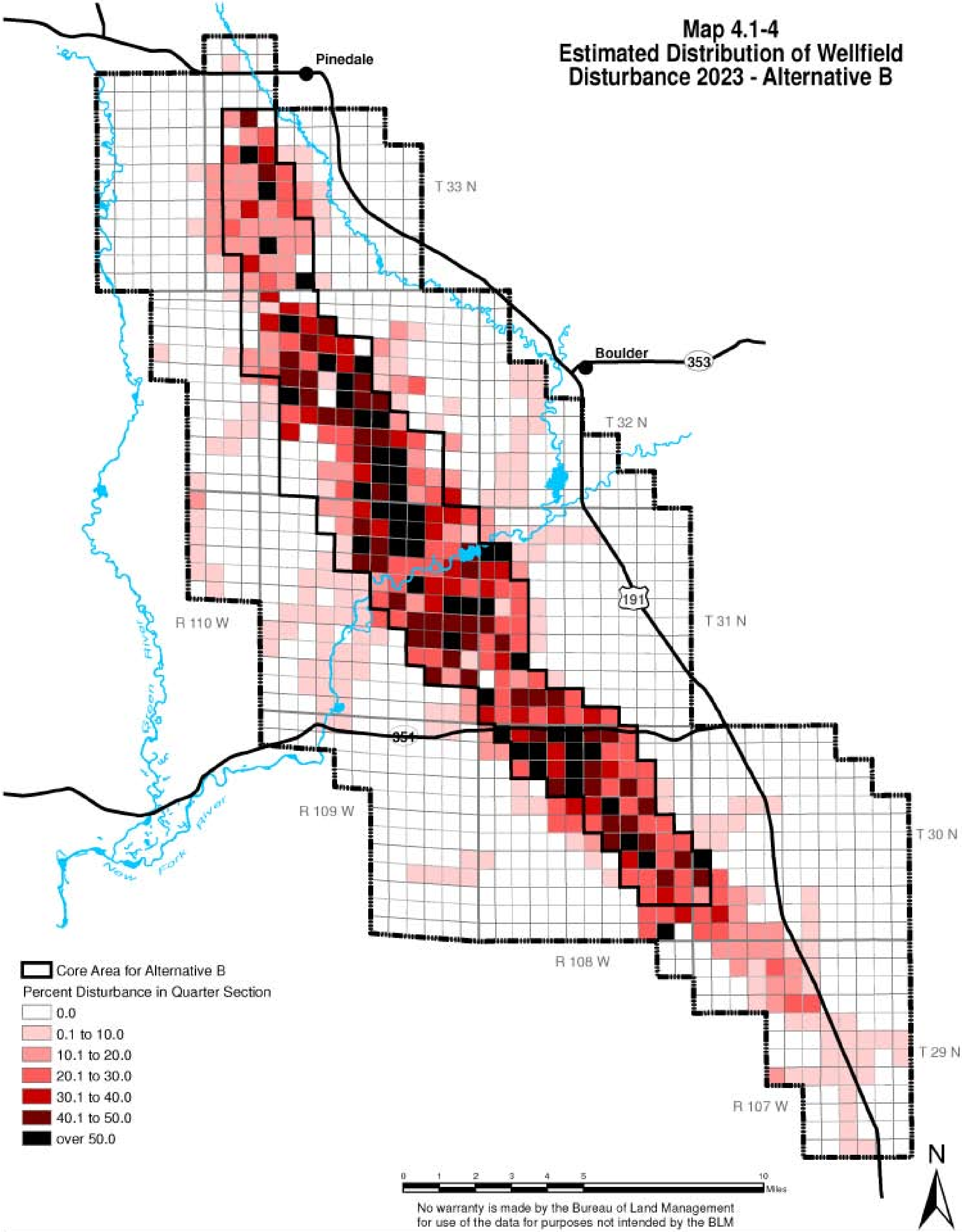
4.1.2.3 Alternative C

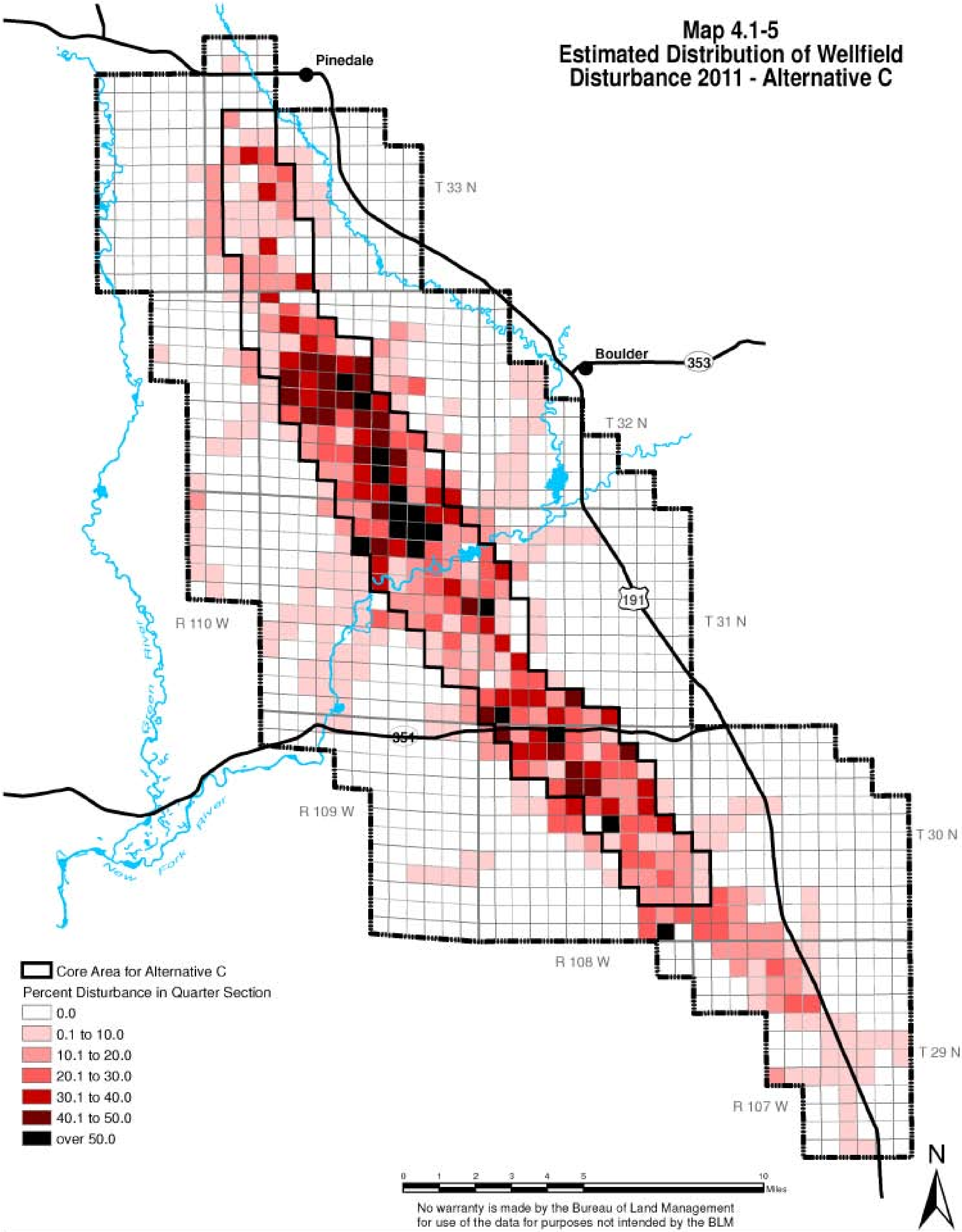
As with each of the other alternatives, the result of spatially modeling Alternative C through 2011 (Map 4.1-5) is one possibility of many outcomes. The spatial distribution of surface disturbance in the PAPA reflects that Alternative C focuses initial development within the south end of DA-1 and within DA-2 and DA-4. There are few additional surface disturbances in the northern portion of DA-1 and within DA-3. New disturbances these areas, and in DA-5, are due to new and/or expanded delineation pads, similar to disturbance by delineation pads under the Proposed Action Alternative. By 2023, surface disturbance associated with Alternative C (Map 4.1-6) would be similar to the spatial distribution of disturbance under the Proposed Action Alternative (Map 4.1-4). Disturbance shown include new well pads, expansion of existing well pads, access roads to newly constructed well pads, natural gas gathering pipelines to new pads, and the liquids gathering system similar to Alternative B. All of the trunk pipelines and ancillary facilities identified in Table 2.4-11 through 2011 and in Table 2.4-12 through 2023 are included in Map 4.1-5 and Map 4.1-6, respectively.

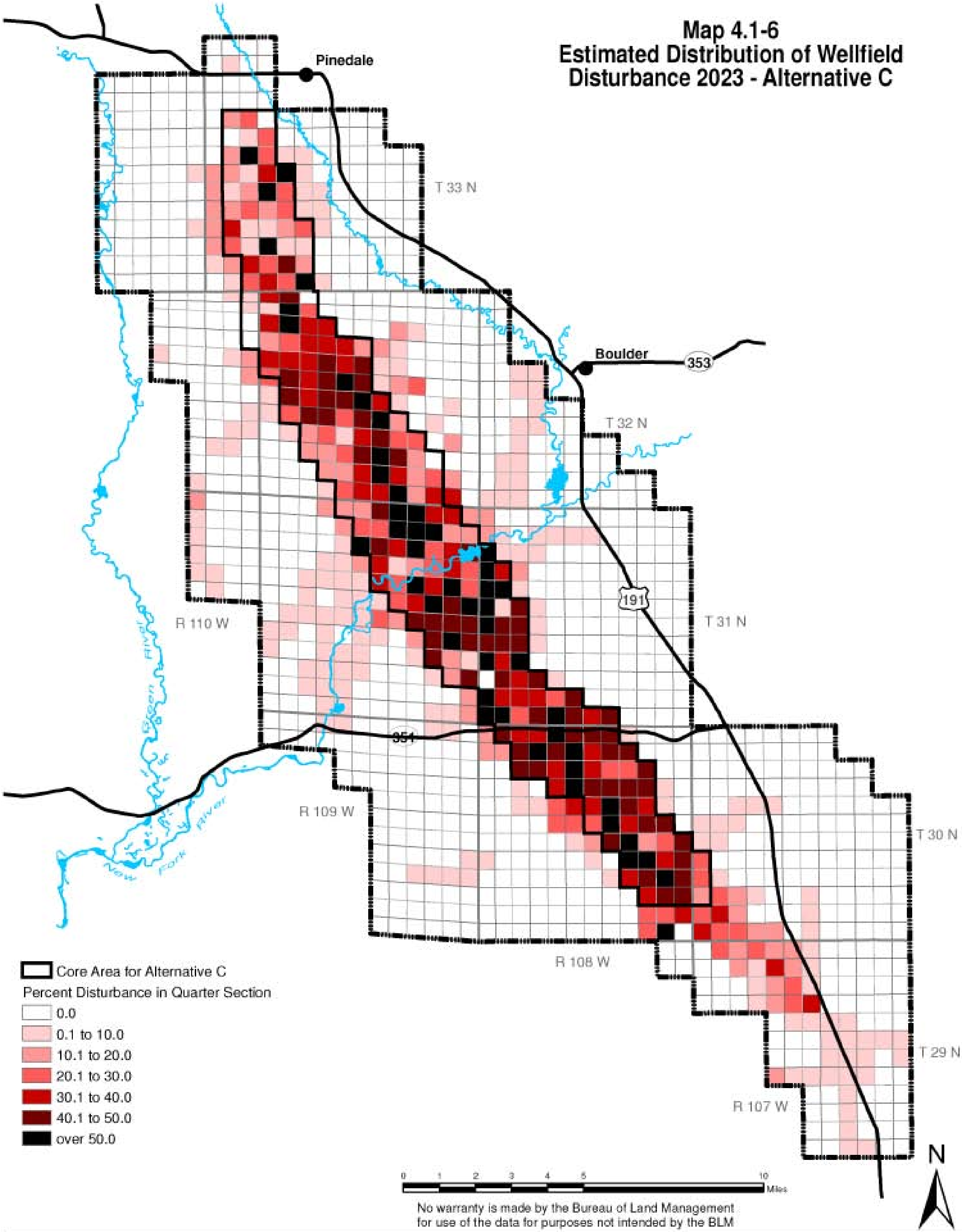

Map 4.1-2
Estimated Distribution of Wellfield Disturbance 2011 - Alternative A
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Percent Disturbance in Quarter Section
0.0
0.1 to 10.0
10.1 to 20.0
20.1 to 30.0
30.1 to 40.0
40.1 to 50.0
over 50.0
0 1 2 3 4 5 10
Miles
N
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM


Map 4.1-3
Estimated Distribution of Wellfield Disturbance 2011 - Alternative B
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Core Area for Alternative B
Percent Disturbance in Quarter Section
0.0
0.1 to 10.0
10.1 to 20.0
20.1 to 30.0
30.1 to 40.0
40.1 to 50.0
over 50.0
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N

Map 4.1-4
Estimated Distribution of Wellfield Disturbance 2023 - Alternative B




Map 4.1-5
Estimated Distribution of Wellfield Disturbance 2011 - Alternative C
Pinedale
Boulder
353
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
191
351
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Core Area for Alternative C
Percent Disturbance in Quarter Section
0.0
0.1 to 10.0
10.1 to 20.0
20.1 to 30.0
30.1 to 40.0
40.1 to 50.0
over 50.0
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N


Map 4.1-6
Estimated Distribution of Wellfield Disturbance 2023 - Alternative C
Pinedale
Boulder
353
191
351
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
R 110 W
R 109 W
R 108 W
R 107 W
Green River
New Fork River
Core Area for Alternative C
Percent Disturbance in Quarter Section
0.0
0.1 to 10.0
10.1 to 20.0
20.1 to 30.0
30.1 to 40.0
40.1 to 50.0
over 50.0
0 1 2 3 4 5 10
Miles
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM
N

4.1.3 Relationship of Spatial Disturbance to Impact Assessment

The modeled distribution of wellfield disturbance in the PAPA under each alternative is the basis for evaluating impact. In the sections below, the actual acreage of total wellfield disturbance has been overlaid with the geographic distribution of each resource (i.e., soils, vegetation, wetlands, etc.).

As an example, the distribution of surface disturbance by quarter section in 2006 was overlaid with the Surface and Mineral Ownership GIS coverage (see Map 3.2-1).

Table 4.1-2 provides the amount (acres) of wellfield disturbance within each ownership category, estimated for each alternative through 2011, and for the Proposed Action Alternative and Alternative C through 2023. As expected (because of the slower pace of development due to winter drilling restrictions), implementation of the No Action Alternative through 2011 results in less disturbance to lands in the Federal Surface/Federal Minerals category and less disturbance within the PAPA overall, compared to the other two alternatives through 2011. Disturbance under the Proposed Action Alternative and Alternative C through 2023 would be similar, in each category and overall.

The pattern of surface disturbance is different within the ownership categories (Table 4.1-2) as wellfield development, by the Proposed Action Alternative and Alternative C, progresses through 2011. For example, there would be less initial surface disturbance on lands in the Private Surface/Private Minerals category by the Proposed Action Alternative compared to initial disturbances produced by Alternative C in 2011. The distinction is reversed by 2023 so that there would be more disturbance by the Proposed Action Alternative than by Alternative C on lands in that ownership category (Table 4.1-2). The reason for the reversal is related to the geographic and timing sequences of wellfield development by the two alternatives. When development is complete in 2023, the distribution and amount of surface disturbance would be similar for the Proposed Action Alternative and Alternative C. Adjustments have not been made for reclamation of initial surface disturbance in this table or any other table in this chapter.

Table 4.1-2
Surface Disturbance in Relation to Land and Mineral Ownership by Alternative

Ownership Category	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Federal Surface/Federal Minerals	3,980.9	3,788.4	5,950.8	5,724.8	10,708.5	10,828.0
Federal Surface/State Minerals	0.0	0.0	0.0	0.0	0.0	0.0
State Surface/State Minerals	507.7	153.9	278.6	339.6	370.6	426.6
Private Surface/Private Minerals	235.3	153.9	188.1	233.5	420.0	365.0
Private Surface/State Minerals	0.0	0.0	0.0	0.0	0.0	0.0
Private Surface/Federal Minerals	335.5	388.3	427.5	558.7	779.3	652.0
Total	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**

Anticipated direct and indirect impacts to each resource are discussed in the sections below. Direct impacts include all effects caused by the action/alternatives that would occur at the same time and place as the action/alternatives (40 CFR §1508.8). Indirect impacts are also caused or induced by the action/alternative but usually involve an intermediate step or process. Consequently, indirect impacts occur later in time or are farther removed in distance from the source of impact, but are still reasonably foreseeable (40 CFR §1508.8).

Cumulative impact analyses within the PAPA applied to the categories in this chapter are the sum of all surface disturbance by "*past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions*" (40 CFR § 1508.7). The analyses include all past and present wellfield disturbance and all existing, non-wellfield disturbance that has been measured within the PAPA. The existing non-wellfield surface disturbance includes agricultural areas, residential areas, industrial sites, Wenz Field (airport), Rendezvous Meadows Golf Course, municipal water treatment facility, gravel pits, stock watering facilities, various residential streets, and arterial highways.

The cumulative impact of surface disturbance in Table 4.1-3 from past and present actions has been added to surface disturbance estimated for each of the alternatives in the reasonably foreseeable future. Included are 426 acres of surface disturbance within the PAPA for new pipelines (R6 and PBC pipelines) for each land and mineral ownership category. Sections of this chapter discussing spatially oriented resources include comparative analyses of surface disturbance impacts associated with each alternative.

Table 4.1-3
Cumulative Surface Disturbance in Relation to Land and Mineral Ownership by Alternative

Ownership Category	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Federal Surface/Federal Minerals	428.0	3,980.9	8,574.8	10,737.2	10,511.2	15,494.9	15,614.4
Federal Surface/State Minerals	0.0	0.0	0.0	0.0	0.0	0.0	0.0
State Surface/State Minerals	23.2	507.7	684.8	809.5	870.5	901.5	957.5
Private Surface/Private Minerals	5,621.5	235.3	6,035.6	6,069.8	6,115.2	6,301.7	6,246.7
Private Surface/State Minerals	4.2	0.0	4.2	4.2	4.2	4.2	4.2
Private Surface/Federal Minerals	1,390.0	335.5	2,137.7	2,176.9	2,308.1	2,528.7	2,401.4
Total	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**

4.1.4 Scoping Issues

Issues pertinent to each resource identified through the public scoping process are included in the introductory impact analysis sections. However, several issues did not fall within a particular resource's domain. The following eight concerns pertain to continued and future development in the PAPA:

1. The pace of development is a concern.
2. A decision should be delayed until BLM has fully evaluated the consequences of previously approved winter drilling projects.

3. BLM should implement adaptive management as a means of determining adequacy of existing research and monitoring programs and determine how management of development would be changed (in addition to applying waivers, modifications or exceptions) once impacts are detected.
4. Current and future operators should be held to commitments and responsibilities through effective monitoring and enforcement.
5. BLM should require all mitigation (directional drilling, gathering system, reduced surface disturbance) and application of improved technology (drilling and casing techniques to prevent blowouts) without removing seasonal stipulations.
6. There is concern over existing compliance with regulatory standards for air quality and water quality, including residential water sources.
7. BLM should consider at least one conservation alternative.
8. An alternative should be considered that protects wildlife habitat in portions of the PAPA while allowing development in other portions.

4.2 ENVIRONMENTAL JUSTICE

Chapter 4 of the PAPA DEIS (BLM, 1999a) provides a discussion of the basis for Environmental Justice, and it is not repeated here. The PAPA DEIS referred to the Bureau of Census 1990 population and determined that the racial composition of Sublette County was predominantly white (approximately 97 percent). There are no Indian Tribes in the area affected by any of the alternatives.

Table 3.4-1 provides data from the Bureau of Census 2000 Racial Composition. The data indicate that the racial composition of the three-county area (Sublette, Lincoln and Sweetwater) is still predominantly white (greater than 90 percent overall and greater than 97 percent in Sublette County and Lincoln County). Therefore, the racial composition has not changed since the PAPA DEIS (BLM, 1999a). Table 3.4-1 shows that in all three counties, less than 10 percent of the population is below the poverty line compared to more than 11 percent in Wyoming and more than 12 percent in the United States.

The BLM has determined that none of the alternatives would result in a disproportionately high and adverse human health or environmental impact on minority populations, low-income populations, or Indian Tribes.

4.3 SOCIOECONOMIC RESOURCES

4.3.1 Scoping Issues

Concerns about impacts to socioeconomic resources received during scoping focused on economic stability and the related issues of stable employment, housing, safety, and the human environment. Concerns related to socioeconomic resources are:

1. Though the proposal will provide jobs and economic stability for Sublette County citizens, there is concern for a potential economic “bust”, once development ends.
2. Maintaining winter restrictions would affect seasonal employment, housing, safety, and the human environment in Pinedale and surrounding communities.

4.3.2 Impacts Considered in the PAPA DEIS

Given that little was known about the potential of the PAPA to produce economically recoverable natural gas at the time the PAPA DEIS (BLM, 1999a) was prepared, it was impossible to predict ultimate gas recovery. Without such an estimate, overall revenues from the PAPA were impossible to predict. However, many individuals believed there was potential for positive revenue impacts during scoping in 1999. The following were key assumptions made in the PAPA DEIS about future impact to socioeconomic resources:

- the positive impact to county-wide employment was not expected to be significant, as most employment would result from drilling and completion activities, which were not expected to rely heavily upon local hires;
- a few new residents could be expected in Pinedale;
- increased direct and indirect local employment was expected to be negligible;
- continued exploration and development was not expected to increase housing demand above that presently available;
- some workers might decide to occupy motels in Pinedale, particularly in the winter when rates and occupancy would be low;
- with the exception of ambulance service, increases in demand for local government facilities and services were not expected to exceed capacity; and
- adequate revenues would have been generated by the project to cover any additional costs incurred by local governments.

The PAPA DEIS (BLM, 1999a) considered that the following would be significant impacts, positive and negative, to socioeconomic resources by implementation of any of the alternatives evaluated in the PAPA DEIS (BLM, 1999a), except for the *No Action Exploration/Development Scenario*:

- increased demand for housing resulting from project activities which exceed supply;
- short- or long-term increases in demand for local government facilities or services which exceed existing capacity and are not offset by adequate revenues from continued exploration and development; and
- a 10 percent change in county government revenues or in county-wide employment.

In the PAPA DEIS (BLM, 1999a), based on the criteria above, all alternatives were expected to have a negligible impact on housing demand. In the time since the PAPA DEIS (BLM, 1999a), however, the permanent population of Sublette County grew 17 percent, Lincoln County grew 10 percent, and Sweetwater County grew less than 1 percent. Furthermore, for the period 2006 through 2020, population of the three-county region is forecasted to grow an estimated 10 percent (Table 3.5-7). Housing demand in the three-county region has exceeded supply and the trend is expected to continue (assuming significant recoverable reserves continue to be located and developed in the PAPA).

In the PAPA DEIS (BLM, 1999a), all alternatives, except the *No Action Exploration/Development Scenario*, were expected to have, and have had, a significant positive impact on Sublette County government revenues, due to location and development of significant recoverable reserves in the PAPA. All alternatives were expected to have a negligible effect on employment. Employment, however, has increased significantly (52.5 percent in Sublette County and 17.7 percent in Sweetwater County), as shown in Table 3.5-12. An estimated 14.7 percent of workers employed in the three-county region are employed in jobs associated with exploration and development in the PAPA (see Table 3.5-4).

Several of the key assumptions made in the PAPA DEIS (BLM, 1999a) have been challenged by development in the PAPA occurring from 1999 through 2006. Drilling and completion activities were not expected to rely heavily upon locally hired workers, yet 40 percent of those employed in the PAPA reside in the three-county region. The three-county region was not expected to have many new residents, yet there are 2,794 new residents (2005 estimate, U.S. Census Bureau – see Table 3.5-6), a population growth rate for the three-county region of 5 percent over 5 years.

In the PAPA DEIS (BLM, 1999a), housing demand was not expected to exceed existing vacancies, yet from 2000 to 2004, the change in the number of housing units was 10.8 percent in Lincoln County, 8.6 percent in Sublette County, and 1 percent in Sweetwater County. Though workers were only expected to stay in Pinedale motels in the winter, demand for motel rooms year-round exceeded supply from 1999 to 2006.

4.3.3 Alternative Impacts

Economic impacts are presented in terms of real and nominal impact. A real discount rate was used to adjust and to eliminate the effect of expected inflation to determine the discounted constant-dollar (present value or "real value") of benefits and costs. The real discount factor is calculated as $1/(1+i)^t$ where *i* is the interest rate and *t* is the project year (Office of Management and Budget, 2006). The present value is the value of the activities after the real discount rate has been applied over time. As presented herein, the nominal value of project activities is the simple calculation of dollars with no adjustment (here, in 2003 dollars). The discount rate used for this analysis is 7 percent.

4.3.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Activities Within the PAPA

Local infrastructure, facilities, and services (including ambulance service) have grown to meet increased demand. Tax and royalty revenues from the PAPA have helped local governments to meet these additional costs. There is increased drug and alcohol abuse and diversity of school populations which stretch the affected communities and which impose both fiscal and non-pecuniary costs.

In addition to the market costs and benefits associated with oil and gas drilling and production in the PAPA, non-market economic values are being affected by development, i.e., economic values associated with amenities such as clean air, clean water, open space, and preservation of crucial wildlife habitat that are not bought or sold directly. These amenities have non-market values associated with both use and non-use. For example, it may be worth something to stakeholders to know that open space exists in the PAPA whether or not they visit the PAPA. Though not quantified here, these non-market economic values are affected by all alternatives analyzed in this Draft SEIS.

Although there is evidence of increased demand for housing, increased employment, increased local government revenues, and the accompanying demand for local infrastructure and amenities, the character of the economic growth occurring in the three-county region appears to differ from "booms" that occurred in the region in the 1980s. Sixty percent of the oil and gas workers are non-local (Jacquet, 2006). This non-local workforce is composed of different people cycling through the three-county region, and contract workers who come and go. Accordingly, while these non-local workers make direct, indirect, and induced contributions to economic activity in the three-county region, in some cases they exert less demand on the rental housing market, and population statistics reflect their presence less than would otherwise be seen in a boom involving more local workers.

Housing Demand. From 2000 to 2005, a majority of PAPA workers were based in Pinedale, Boulder, Marbleton, La Barge, and Big Piney. In southwestern Wyoming, local motels and RV parks often experienced year-round full occupancy, rental housing costs increased, and the rental market was tight (see Table 3.5-14 through Table 3.5-17). In Pinedale, 161 motel rooms have been added since 1999 (Sublette County Chamber of Commerce, 2006). A growing number of PAPA workers may be relocating permanently to Sublette County. BLM is analyzing the potential for additional remote housing for workers.

In late 2005, a casual survey was conducted of 524 natural gas industry workers for the PAPA and Jonah Field Project Area. Almost half of the respondents (212) considered themselves non-residents, and 64 percent of these non-residents (136 individuals or families) said they were at least considering permanently relocating to the area. Respondents were more interested in moving to Sublette County (especially Pinedale and Boulder) than Sweetwater County (Sublette SE, 2006). As long as employment in the PAPA is strong and demand for housing exceeds supply, market pressure on housing costs would contribute to a higher cost of living and higher inflation rates.

Demand for Services and Facilities. Potentially impacted services include schools, rural fire departments, emergency medical services, and law enforcement. Three of the five school districts in the three-county region are experiencing increased enrollments. The two Sublette CSDs and the Sweetwater ISD #1 are planning to add schools to accommodate increasing student numbers, particularly in the elementary schools (see Table 3.5-18). Both the Pinedale Volunteer Fire Department and the Sublette Rural Health Care District have added equipment and personnel during the period 1999 to 2006 and are adequately meeting demands (Mitchell, 2006 and McGinnis, 2006). Law enforcement agencies in the three-county region report increasing demand for services and some stress on existing resources, but also that local governments are being responsive to their resource requests and their concerns (Hanson, 2006a, McConkie, 2006 and Kessler, 2006).

Boom-Bust Characteristics. To date, in the three-county region, there has been only limited cyclical activity in employment and earnings associated with activity in the PAPA. Under all alternatives, employment is strongest during the development phase (well drilling and completion), and then drops when the field is in the production phase only. Production makes less difference than drilling in employment and earnings trends associated with activity in the PAPA. Because drilling extends for a longer period under the Proposed Action Alternative and Alternative C than under the No Action Alternative, total earnings from oil and gas production would drop more sharply and sooner under the No Action Alternative. Furthermore, total nominal earnings in each year are greater under the Proposed Action Alternative and Alternative C than under the No Action Alternative.

Economic Benefits. Table 4.3-1 shows the direct, indirect, and induced economic effects to the local economy (Lincoln, Sublette, and Sweetwater counties) from natural gas drilling in the PAPA on a per-well basis. Impact from drilling was analyzed using estimates of economic activity for the three-county region generated using the IMPLAN model, a community impact assessment modeling system using input-output analysis (Minnesota IMPLAN Group, 2006). Each well drilled puts $4,715,100 directly into the local economy (local earnings plus wages to employees). Indirect contributions, associated with secondary economic goods and services attributed to industrial purchases in conjunction with PAPA drilling, amount to $497,776. Induced contributions, associated with household purchases by the employees involved in direct and indirect economic activities in the PAPA, amount to $322,985. The Operators currently estimate that 40 percent of the workers drilling a typical well in the PAPA reside locally. It is estimated that 47.4 total jobs are associated with a typical well in the PAPA. The direct economic employment is 38 workers in the PAPA to drill a typical well. An additional 5.3 workers are employed in activities that have an indirect economic impact. Finally, 10.2 workers are employed in activities that have an induced economic impact. Average annual earnings per drilling job are $51,291 for 2007 through 2011. An annual job equivalent is one job for 12 months, two jobs for 6 months or three jobs for 4 months. This exceeds the average earnings per job in Lincoln County ($30,438), in Sublette County ($31,715) and in Sweetwater County ($38,698), thus employment in the PAPA would contribute to raising wage levels in the three-county region for the period 2007 through 2011.

Table 4.3-1
Economic Impact of PAPA Drilling[1]

Output	Dollars Per Well 40 Percent Local Workers
Direct	4,715,100
Indirect	497,776
Induced	322,985
Total	5,535,861
Employment, Number of Workers:	
Direct (local 40%)	15.2
Indirect (non-local 60%)	22.8
Indirect	5.3
Induced	4.1
Total	47.4
Worker Earnings:	
Direct	$2,187,536
Indirect	$152,073
Induced	$90,570
Total Worker Earnings	$2,430,179
Average Earnings Per Job	$51,291

[1] In 2003 Dollars.

The estimates of oil and gas production in the PAPA assume that the life of an average well is 40 years, and that it produces 5,000 MMCF (million cubic feet) of natural gas and 35,000 barrels of condensate. Accordingly, average annual natural gas production is 125 MMCF of natural gas and 875 barrels of condensate. This is an annual average and does not imply that a single well produces this level each year. Production rates are typically highest when a well is first drilled, declines rapidly, and then levels off for the life of the well (Figure 4.3-1).

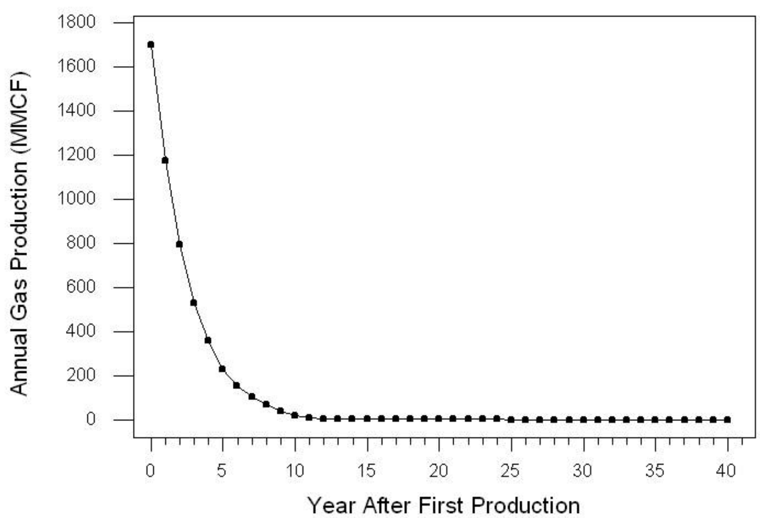


Figure 4.3-1
Estimated Average Well Production Profile

Table 4.3-2 assumes that all workers employed in production in the PAPA reside in the three-county region. For each MMCF of natural gas produced, activity in the PAPA generates $5,020.00 in direct economic impacts (i.e., local earnings plus wages paid to those employed in the PAPA), $158.08 in indirect economic impacts (i.e., secondary economic activity due to industrial purchases), and $32.54 in induced economic impacts (i.e., household expenditures by PAPA employees). The total economic impact generated by one MMCF of PAPA natural gas from drilling is $5,210.62. There is one direct job in oil and gas extraction per 996 MMCF of natural gas produced in the PAPA. The average annual earnings per job for a worker involved in natural gas production in the PAPA are $52,243.

Table 4.3-2
Economic Impact of PAPA Production[1]

Output	Per MMCF Produced	Per Average Well, Per Year
Direct	$5,020.00	$627,500
Indirect	$158.08	$19,760
Induced	$32.54	$4,067.50
Total	$5,210.62	$651,327.50
Employment:		
Direct	0.001004	0.1255
Indirect	0.000502	0.06275
Induced	0.000502	0.06275
Total	0.002008	0.251
Earnings:		
Direct	$66.74	$8,342.50
Indirect	$29.04	$3,630.00
Induced	$9.12	$1,140.00
Total	**$104.90**	**$13,112.50**

[1] In 2003 Dollars.

Figure 4.3-1 shows the profile of annual natural gas production for an average well in the PAPA. This profile is used in forecasting production earnings over time in the PAPA .

Government Revenues. The potential for development of the PAPA to provide significant economic benefit to federal, state, and local governments can be demonstrated by considering the revenues generated by the PAPA since the PAPA DEIS (BLM, 1999a) (see Tables 3.5-19, 3.5-20, and 3.5-21).

Table 4.3-3 provides the royalty and tax revenues generated by a PAPA well in 2006. The estimates of oil and gas production for an average PAPA well assume that the life of a well is 40 years, and that it produces 5,000 MMCF of natural gas and 35,000 barrels of condensate. Accordingly, average annual natural gas production is 125 MMCF and average annual condensate production is 875 barrels.

Table 4.3-3
Royalties and Tax Revenues for a Typical Natural Gas Well in the PAPA in 2006[1]

Tax and Royalty Revenues	$/MMCF	$/Well/Year
Federal mineral royalty – U.S. Government	500.00	64,976
Severance tax – State of Wyoming	304.70	39,597
Ad valorem (production) – Sublette County	320.00	41,585
TOTAL	**1124.70**	**146,158**

[1] Represents the total federal mineral royalties for natural gas production and gas plant products in Wyoming divided by the natural gas production sales volume for Wyoming in 2005.
Source: Mineral Management Services, 2006.

Royalties are paid on net revenues (gross revenues minus operating expenses). State severance tax and ad valorem taxes are paid after royalties are deducted. Approximately 78 percent of the existing well pads in the PAPA have been drilled on federal leases; the federal royalty is 12.5 percent of production revenues (after operating costs). Wells on state owned minerals incur royalties to the State of Wyoming (16.7 percent of production revenues, after operating costs) and royalties on privately owned minerals are paid to the owner of the mineral rights. A typical PAPA well to generated $500 per MMCF in federal mineral royalty payments in 2005. Half of the federal mineral royalty was returned to the State of Wyoming ($250 per MMCF). The State of Wyoming distributes the returned portion of the federal mineral royalty from a typical PAPA well as shown in Table 4.3-4.

Table 4.3-4
State of Wyoming Distribution of Federal Mineral Royalty for a Typical Gas Well in the PAPA in 2005

Percent Allocation of State Share	Percent
Cities and towns	3.0
University of Wyoming	2.1
Foundation funds	35.7
Capital facility revenue boards	1.0
Highway fund	9.6
Highway fund – state roads	0.7
Cities, counties and special district capital construction	1.2
School district grants	0.9
General fund – 1 percent	0.3
Budget reserve account	45.5
Total	**100.0**

Ad valorem taxes (i.e., property taxes) from the PAPA are paid to Sublette County. The total ad valorem taxes collected in Sublette County during 2005 were $164 million (Montgomery, 2006). Ninety four percent of the total ad valorem taxes collected were from mineral production (compared with 75 percent in 1998). As the value of the mineral production in the county increases, the mil levy tends to decrease, creating a situation in which all other taxpayers (residential, commercial, industrial, and agricultural) pay lower taxes. If economically recoverable PAPA reserves continue to be developed and/or if production from the PAPA increases, then the percentage of total property taxes paid by non-mineral taxpayers would continue to decrease.

The distribution of ad valorem taxes (using the 2005 mil levy structure) is shown in Table 4.3-5. The calculations assume that, on average, a PAPA well produces 125 MMCF of natural gas and 875 barrels of condensate per year over the 40-year life of the well.

Table 4.3-5
Distribution of Ad Valorem Tax Collected by Sublette County from a Typical PAPA Well during Production in 2005

Entities Receiving Ad Valorem Tax Shares	Percent	Dollars per MMCF	Dollars per well
Total ad valorem tax collected on production		320.00	41,585
Allocated as Follows:			
State of Wyoming Schools (12 mils)	20.6	65.96	8,571
Sublette County Schools (32 mils)	55.0	175.88	22,857
Total Tax Retained by Sublette County			
County General Fund (10.82 mils)	18.6	59.47	7,728
Fair (0.083 mils)	0.1	0.46	59
Airport (0.103 mils)	0.2	0.57	74
Library (0.219 mils)	0.4	1.20	156
Museum (0.136 mils)	0.2	0.75	97
Recreation (0.241 mils)	0.4	1.32	172
Fire (0.399 mils)	0.7	2.19	285
Rural Health (2.0 mils)	3.4	10.99	1,429
Weed & Pest (0.17 mils)	0.3	0.93	121
Upper Green Cemetery (0.049 mils)	0.1	0.27	35
Source: Montgomery, 2006 Note: School funding does not consider recapture by the state.			

Approximately 20 percent of the total property tax collected by Sublette County would be sent to the State of Wyoming School Foundation ($8,571 per well). In some years, additional ad valorem tax revenue could go to State School Funding, subject to recapture provisions that are determined by the Wyoming legislature. The remaining tax (approximately $33,014 per well) would stay in Sublette County and would be distributed as shown in Table 4.3-5.

Pipeline Corridors and Gas Sales Pipelines

Effects on socioeconomic conditions from the establishment of the transportation corridors and construction of gas sales pipelines would be generally less than 1 year. A peak workforce of 200 to 300 workers for construction of an individual pipeline is projected for 3 to 5 months. Both qualified local workers and non-local workers would make up the workforce for each pipeline project. These jobs are mostly temporary in nature and therefore, non-local workers would be likely to make up a majority of the workforce. For similar pipeline projects in the region, it has been typical for non-local workers to make up 50 to 80 percent of the workforce (Northwest Pipeline Corporation, 2005). An estimated 30 percent of non-local workers would bring their own temporary housing (i.e., recreational vehicles or tents) (Entrega, 2004). A temporary increase in demand for housing is expected in communities near the proposed pipeline alignments during a period when temporary housing markets are already being strained by demand. There would be increased demand for a limited range of community services, including emergency response, medical services, and law enforcement. Construction of pipelines would generate additional economic benefits of employment and income and subsequent expenditures by workers for goods and services in the affected counties (Sublette, Sweetwater, Lincoln and Uinta). Additional public sector revenues for federal, state, and local government entities would be generated. Once constructed, a relatively small number of workers (i.e., five to ten professionals) would be required to operate and maintain the pipelines.

There would be a potential for accidents and fires, including those along transportation/access routes, along pipeline rights-of-way, and at work sites. Accidents or fires would require emergency response (fire suppression and/or ambulance) and law enforcement services.

4.3.3.2 Alternative A (No Action Alternative)

Table 4.3-6 shows the employment and nominal earnings associated with drilling in the PAPA under the No Action Alternative. The IMPLAN model (Minnesota IMPLAN Group, 2006) was used to analyze estimates of economic activity for the three-county region under all alternatives.

Table 4.3-6
Employment and Nominal Earnings associated with Drilling under the No Action Alternative (2007 through 2011)[1,2]

Year	Total Wells	Total Employment 47.4 workers/well	Total Earnings $2,430,179/well
2007	231	10,945	$561,371,257
2008	235	11,134	$571,091,971
2009	236	11,182	$573,522,150
2010	217	10,281	$527,348,756
2011	220	10,424	$534,639,292
Total	1,139	53,966	$2,767,973,426
Average	228	10,793	$553,594,685
Net Present Value, 2007-2011			$2,275,127,060

[1] In 2003 dollars.
[2] Assumes 40 percent of workers are local.

Under the No Action Alternative, the net present value of the stream of earnings from drilling is $2,275,127,060. Table 4.3-7 shows the employment and nominal earnings associated with production in the PAPA under the No Action Alternative.

Table 4.3-7
Employment and Nominal Earnings associated with Production under the No Action Alternative (2007 through 2051)[1]

Year	Number of Production Workers	Total Earnings
2007	972	$50,762,813
2008	1,209	$63,176,566
2009	1,405	$73,401,367
2010	1,510	$78,881,786
2011	1,571	$82,087,680
2012	1,581	$82,592,124
2013	1,081	$56,498,122
2014	741	$38,716,229
2015	509	$26,585,613
2016	350	$18,299,698
2017	242	$12,631,437

Year	Number of Production Workers	Total Earnings
2018	167	$8,747,026
2019	116	$6,079,566
2020	81	$4,243,377
2021	57	$2,975,866
2022	40	$2,098,078
2023	28	$1,487,930
2024	20	$1,062,025
2025	15	$763,310
2026	11	$552,683
2027	8	$403,290
2028	6	$296,646
2029	4	$219,987
2030	3	$164,472
2031	2	$123,958
2032	2	$94,151
2033	1	$72,044
2034	1	$55,513
2035	1	$43,052
2036	1	$33,586
2037	1	$26,342
2038	0	$20,759
2039	0	$16,429
2040	0	$13,050
2041	0	$10,398
2042	0	$8,269
2043	0	$6,563
2044	0	$5,189
2045	0	$4,046
2046	0	$3,134
2047	0	$2,315
2048	0	$1,630
2049	0	$1,074
2050	0	$624
2051	0	$281
Net Present Value, 2007-2051		$435,068,074

[1] In 2003 dollars.

The net present value of the stream of earnings from production in the PAPA under the No Action Alternative, 2007 through 2051 is $435,068,074. Under the No Action Alternative, production in the PAPA would continue through 2051, generating federal, state, and local tax revenues, as described in Table 4.3-8.

Table 4.3-8
Nominal Tax Revenues associated with Drilling (through 2011) and Production (through 2051) under the No Action Alternative[1]

Year	Total FMR ($500 per MMCF)	FMR-Wyoming ($250 per MMCF)	Severance Tax ($304.70 per MMCF)	Ad Valorem Production ($320 per MMCF)
2007	$219,049,562	$109,524,781	$133,488,803	$140,191,719
2008	$272,611,265	$136,305,633	$166,129,305	$174,471,210
2009	$316,734,274	$158,367,137	$193,017,867	$202,709,936
2010	$340,379,177	$170,189,589	$207,427,071	$217,842,673
2011	$359,183,241	$179,591,620	$218,886,267	$229,877,274
2012	$246,678,246	$123,339,123	$150,325,723	$157,874,077
2013	$169,232,530	$84,616,265	$103,130,304	$108,308,819
2014	$116,362,836	$58,181,418	$70,911,512	$74,472,215

Year	Total FMR ($500 per MMCF)	FMR-Wyoming ($250 per MMCF)	Severance Tax ($304.70 per MMCF)	Ad Valorem Production ($320 per MMCF)
2015	$80,219,878	$40,109,939	$48,885,994	$51,340,722
2016	$55,470,992	$27,735,496	$33,804,023	$35,501,435
2017	$38,491,429	$19,245,714	$23,456,677	$24,634,515
2018	$26,815,866	$13,407,933	$16,341,589	$17,162,154
2019	$18,766,351	$9,383,175	$11,436,214	$12,010,465
2020	$13,199,859	$6,599,929	$8,043,994	$8,447,910
2021	$9,336,974	$4,668,487	$5,689,952	$5,975,664
2022	$6,645,588	$3,322,794	$4,049,822	$4,253,177
2023	$4,761,917	$2,380,959	$2,901,912	$3,047,627
2024	$3,436,842	$1,718,421	$2,094,412	$2,199,579
2025	$2,499,435	$1,249,718	$1,523,156	$1,599,639
2026	$1,832,151	$916,075	$1,116,513	$1,172,576
2027	$1,353,940	$676,970	$825,091	$866,522
2028	$1,008,748	$504,374	$614,731	$645,599
2029	$757,669	$378,835	$461,724	$484,908
2030	$573,593	$286,797	$349,548	$367,100
2031	$437,541	$218,770	$266,637	$280,026
2032	$336,159	$168,079	$204,855	$215,142
2033	$259,999	$130,000	$158,444	$166,400
2034	$202,334	$101,167	$123,302	$129,494
2035	$158,340	$79,170	$96,492	$101,337
2036	$124,535	$62,267	$75,892	$79,702
2037	$98,386	$49,193	$59,956	$62,967
2038	$78,033	$39,017	$47,554	$49,941
2039	$62,105	$31,052	$37,847	$39,747
2040	$49,576	$24,788	$30,211	$31,728
2041	$39,665	$19,833	$24,172	$25,386
2042	$31,653	$15,826	$19,289	$20,258
2043	$25,197	$12,598	$15,355	$16,126
2044	$19,966	$9,983	$12,167	$12,778
2045	$15,600	$7,800	$9,506	$9,984
2046	$12,094	$6,047	$7,370	$7,740
2047	$8,939	$4,469	$5,447	$5,721
2048	$6,293	$3,146	$3,835	$4,027
2049	$4,142	$2,071	$2,524	$2,651
2050	$2,402	$1,201	$1,464	$1,537
2051	$1,070	$535	$652	$684
Total, 2007-2051	**$2,307,376,391**	**$1,153,688,195**	**$1,406,115,173**	**$1,476,720,890**
Average, 2007-2051	$51,275,031	$25,637,515	$31,247,004	$32,816,020
Net Present Value, 2007-2051	$1,680,010,301	$840,005,150	$1,023,798,277	$1,075,206,592
2007-2011	$1,507,957,519	$753,978,760	$918,949,312	$965,092,812
Average for 2007-2011	$301,591,504	$150,795,752	$183,789,862	$193,018,562
Net Present Value, 2007-2011	$1,217,144,300	$608,572,150	$741,727,736	$778,972,352

[1] In 2003 dollars (assumes 2005 prices, taxes, and conversions).

The estimated employment in the three-county region would peak in 2009 at 12,587 drilling and production workers, of which the majority would be employed in drilling. With the end of drilling in 2011, the number of total workers in the three-county area would drop by 10,414. At peak employment in 2009, 12,587 drilling and production workers and some of their families would be exerting pressure on the housing market (temporary and permanent) and would be demanding local services and infrastructure. After 2011, however, an estimated 10,414 drilling and production workers would be unemployed. If current trends continue, then approximately 40 percent of this workforce (4,166 drilling and production workers) would be local. They would be competing in a tight job market or would be unemployed. Approximately 60 percent (6,248 drilling and production workers) would be leaving the three-county region, thus creating a glut in the local temporary housing market and increasing the vacancies in local motels.

Beginning in 2009, unemployment in the region would be expected to increase and the average earnings per job would decrease, as drilling and production jobs in the PAPA decline. Local governments might experience difficulty providing amenities and infrastructure (including support to local schools), as the share of tax levies generated from oil and gas production begins to decline in 2012.

4.3.3.3 Alternative B (Proposed Action Alternative) and Alternative C

Alternatives B and C through 2011

The economic impacts of the Proposed Action Alternative and Alternative C are similar because both alternatives include the same number of wells drilled per year and the same number of drilling rigs operating in the PAPA and thus, the same pace of production. Table 4.3-9 shows the employment and nominal earnings associated with drilling in the PAPA under the Proposed Action Alternative and Alternative C from 2007 to 2011.

Table 4.3-9
Employment and Nominal Earnings associated with Drilling under the Proposed Action Alternative and Alternative C[1,2]

Year	Total Wells	Total Employment (47.4 workers per well)	Total Earnings ($2,430,179 per well)
2007	268	12,698	$651,287,865
2008	299	14,167	$726,623,401
2009	305	14,451	$741,204,473
2010	291	13,788	$707,181,973
2011	290	13,740	$704,751,794
Total	**1,453**	**68,844**	**$3,531,049,506**
Average	291	13,769	$706,209,901
Net Present Value, 2007-2011			$2,890,368,935

[1] Expressed in 2003 dollars
[2] Assumes 40 percent of workers are local.

Under the Proposed Action Alternative and Alternative C, the net present value of the stream of earnings for 2007 through 2011 is $2,890,368,935.

Alternatives B and C through 2023

Table 4.3-10 shows employment and nominal earnings associated with drilling under the Proposed Action Alternative and Alternative C from 2007 through 2025. Economic impacts associated with drilling were projected through 2025 rather than 2023 because drilling extends through 2025.

Table 4.3-10
Employment and Nominal Earnings associated with Drilling under the Proposed Action Alternative and Alternative C[1,2]

Year	Total Wells	Total Employment (47.4 workers per well)	Total Earnings ($2,430,179 per well)
2007	268	12,698	$651,287,865
2008	299	14,167	$726,623,401
2009	305	14,451	$741,204,473
2010	291	13,788	$707,181,973
2011	290	13,740	$704,751,794
2012	289	13,693	$702,321,615
2013	288	13,645	$699,891,437
2014	287	13,598	$697,461,258
2015	287	13,598	$697,461,258
2016	286	13,551	$695,031,080
2017	282	13,361	$685,310,365
2018	279	13,219	$678,019,829
2019	213	10,092	$517,628,042
2020	187	8,860	$454,443,398
2021	177	8,386	$430,141,612
2022	143	6,775	$347,515,540
2023	112	5,307	$272,180,003
2024	107	5,070	$272,180,003
2025	9	426	$21,871,607
Total	**4,399**	**208,425**	**$10,690,355,661**
Average	232	10,970	$562,650,298
Net Present Value, 2007-2025			$6,393,270,699

[1] In 2003 dollars.
[2] Assumes 40 percent of workers are local.

Under the Proposed Action Alternative and under Alternative C, the net present value of the stream of earnings associated with drilling from 2007 through 2025 is $6,393,270,699.

Table 4.3-11 shows the employment and total earnings associated with production in the PAPA under the Proposed Action Alternative and Alternative C. These figures include local revenues from the sale of oil and gas, local wages, and indirect and induced economic activity.

Table 4.3-11
Employment and Nominal Earnings associated with Production under the Proposed Action Alternative and Alternative C[1]

Year	Total Employment	Total Earnings
2007	1,063	$55,540,092
2008	1,429	$74,672,039
2009	1,704	$89,014,077
2010	1,910	$99,770,677
2011	2,094	$109,402,328
2012	2,191	$114,486,756
2013	2,184	$114,122,025
2014	2,134	$111,482,777

Year	Total Employment	Total Earnings
2015	2,097	$109,537,845
2016	2,073	$108,278,857
2017	2,094	$109,405,600
2018	2,095	$109,424,702
2019	1,956	$102,181,143
2020	1,724	$90,086,049
2021	1,520	$79,422,614
2022	1,364	$71,244,305
2023	1,231	$64,323,192
2024	1,116	$58,278,380
2025	1,013	$52,912,967
2026	920	$48,084,908
2027	837	$43,725,805
2028	762	$39,792,821
2029	694	$36,244,575
2030	632	$33,037,219
2031	577	$30,137,632
2032	527	$27,512,917
2033	481	$25,135,859
2034	440	$22,979,466
2035	402	$21,018,950
2036	368	$19,240,510
2037	337	$17,626,180
2038	309	$16,156,050
2039	284	$14,816,223
2040	260	$13,594,505
2041	240	$12,514,152
2042	220	$11,502,284
2043	203	$10,600,790
2044	187	$9,769,891
2045	172	$8,988,644
2046	153	$8,009,345
2047	134	$6,977,462
2048	113	$5,916,266
2049	96	$5,008,289
2050	82	$4,292,440
2051	72	$3,768,062
2052	63	$3,287,462
2053	55	$2,889,998
2054	52	$2,714,017
2055	49	$2,563,653
2056	46	$2,424,319
2057	44	$2,294,973
2058	42	$2,174,685
2059	39	$2,062,628
2060	37	$1,958,062
2061	36	$1,860,325
2062	34	$1,768,828
2063	32	$1,683,040
2064	31	$1,602,489
2065	29	$1,526,747
Net Present Value, 2007 - 2065		$1,037,642,883

[1] In 2003 dollars.

The net present value of the stream of earnings for 2007 through 2065 under the Proposed Action Alternative and Alternative C is $1,037,642,883. Table 4.3-12 shows the nominal tax revenues associated with drilling through 2007 and production through 2065 under the Proposed Action Alternative and Alternative C.

Table 4.3-12
Nominal Tax Revenues associated with Drilling (through 2025) and Production (through 2065) under the Proposed Action Alternative and Alternative C[1]

Year	Total FMR ($500 per MMCF)	FMR-Wyoming ($250 per MMCF)	Severance Tax ($304.70 per MMCF)	Ad Valorem Production ($320 per MMCF)
2007	$239,654,568	$119,827,284	$146,045,494	$153,378,924
2008	$322,194,535	$161,097,268	$196,345,350	$206,204,502
2009	$384,085,992	$192,042,996	$234,062,004	$245,815,035
2010	$430,504,084	$215,252,042	$262,349,189	$275,522,614
2011	$472,060,958	$236,030,479	$287,673,948	$302,119,013
2012	$493,997,247	$246,998,623	$301,041,922	$316,158,238
2013	$492,415,213	$246,207,607	$300,077,831	$315,145,736
2014	$481,009,600	$240,504,800	$293,127,250	$307,846,144
2015	$472,603,619	$236,301,810	$288,004,645	$302,466,316
2016	$467,161,689	$233,580,844	$284,688,333	$298,983,481
2017	$472,011,522	$236,005,761	$287,643,822	$302,087,374
2018	$472,087,538	$236,043,769	$287,690,146	$302,136,024
2019	$440,847,122	$220,423,561	$268,652,236	$282,142,158
2020	$388,669,776	$194,334,888	$236,855,361	$248,748,657
2021	$342,664,758	$171,332,379	$208,819,904	$219,305,445
2022	$307,382,996	$153,691,498	$187,319,198	$196,725,118
2023	$277,525,261	$138,762,631	$169,123,894	$177,616,167
2024	$251,447,913	$125,723,956	$153,232,358	$160,926,664
2025	$228,301,342	$114,150,671	$139,126,838	$146,112,859
2026	$207,472,687	$103,736,343	$126,433,855	$132,782,519
2027	$188,666,903	$94,333,451	$114,973,611	$120,746,818
2028	$171,699,247	$85,849,624	$104,633,521	$109,887,518
2029	$156,391,233	$78,195,616	$95,304,817	$100,090,389
2030	$142,553,717	$71,276,859	$86,872,235	$91,234,379
2031	$130,043,854	$65,021,927	$79,248,725	$83,228,067
2032	$118,719,747	$59,359,874	$72,347,814	$75,980,638
2033	$108,464,002	$54,232,001	$66,097,963	$69,416,961
2034	$99,160,166	$49,580,083	$60,428,205	$63,462,507
2035	$90,701,317	$45,350,658	$55,273,383	$58,048,843
2036	$83,027,955	$41,513,978	$50,597,236	$53,137,891
2037	$76,062,588	$38,031,294	$46,352,541	$48,680,056
2038	$69,719,318	$34,859,659	$42,486,952	$44,620,363
2039	$63,938,185	$31,969,093	$38,963,930	$40,920,438
2040	$58,666,601	$29,333,301	$35,751,427	$37,546,625
2041	$54,005,027	$27,002,513	$32,910,663	$34,563,217
2042	$49,638,792	$24,819,396	$30,249,880	$31,768,827
2043	$45,748,849	$22,874,424	$27,879,349	$29,279,263
2044	$42,163,422	$21,081,711	$25,694,389	$26,984,590
2045	$38,792,231	$19,396,116	$23,639,986	$24,827,028
2046	$34,566,223	$17,283,111	$21,064,656	$22,122,382
2047	$30,113,219	$15,056,610	$18,350,996	$19,272,460
2048	$25,533,659	$12,766,829	$15,560,212	$16,341,542
2049	$21,615,323	$10,807,661	$13,172,378	$13,833,807
2050	$18,526,132	$9,263,066	$11,289,825	$11,856,725
2051	$16,263,247	$8,131,623	$9,910,823	$10,408,478
2052	$14,189,263	$7,094,631	$8,646,937	$9,081,128

Year	Total FMR ($500 per MMCF)	FMR-Wyoming ($250 per MMCF)	Severance Tax ($304.70 per MMCF)	Ad Valorem Production ($320 per MMCF)
2053	$12,474,038	$6,237,019	$7,601,679	$7,983,384
2054	$11,714,656	$5,857,328	$7,138,911	$7,497,380
2055	$11,065,801	$5,532,900	$6,743,499	$7,082,113
2056	$10,464,533	$5,232,266	$6,377,086	$6,697,301
2057	$9,906,351	$4,953,176	$6,036,931	$6,340,065
2058	$9,387,250	$4,693,625	$5,720,590	$6,007,840
2059	$8,903,653	$4,451,827	$5,425,886	$5,698,338
2060	$8,452,374	$4,226,187	$5,150,877	$5,409,519
2061	$8,030,562	$4,015,281	$4,893,824	$5,139,559
2062	$7,635,668	$3,817,834	$4,653,176	$4,886,827
2063	$7,265,410	$3,632,705	$4,427,541	$4,649,863
2064	$6,917,743	$3,458,871	$4,215,672	$4,427,355
2065	$6,590,828	$3,295,414	$4,016,451	$4,218,130
Total	**$9,711,877,507**	**$4,855,938,754**	**$5,918,418,153**	**$6,215,601,605**
Average	$164,608,093	$82,304,047	$100,312,172	$105,349,180
Net Present Value, 2007-2065	$4,476,921,330	$2,238,460,665	$2,728,235,859	$2,865,229,651
2007-2011	$1,848,500,138	$924,250,069	$1,126,475,984	$1,183,040,088
Average for 2007-2011	$369,700,028	$184,850,014	$225,295,197	$236,608,018
Net Present Value, 2007-2011	$1,483,924,440	$741,962,220	$904,303,554	$949,711,642
[1] In 2003 dollars (assumes 2005 prices, taxes, and conversions).				

The average number of PAPA drilling and production workers in the three-county region for the period 2007 to 2018 would be 15,548. During this period, on average, 15,548 workers and their families would be exerting pressure on the housing market (both temporary and permanent) and would be demanding local services and infrastructure. If current trends continue, approximately 40 percent of this workforce would be local, thus 60 percent of these individuals and families (9,329 workers) would be continuing to exert pressure on a tight rental housing and motel room market from 2007 through 2018. However, it is likely that the market would accommodate ongoing demand pressure for temporary housing. There may be a market for housing (as second homes) when oil and gas workers depart, depending upon the quality of the permanent and temporary housing that is constructed.

The demand for drilling and production workers under the Proposed Action Alternative and Alternative C would taper more gradually than under the No Action Alternative. Under the Proposed Action Alternative and Alternative C, the decline in the demand for drilling and production workers would begin in 2019, when an estimated 60 percent of 3,266 workers (1,960 workers) would be likely to leave the region. A glut in the temporary housing and motel room markets would follow. An estimated 1,306 workers would be unemployed and entering the job market in 2019. Under the Proposed Action Alternative and Alternative C, the largest drop in demand for drilling and production workers would occur in 2025, the year drilling ends, when 4,746 workers would be unemployed, of whom 2,948 would leave the region, adding to the surplus in the temporary housing and motel room market. Additionally, 1,898 workers would be looking for work in the three-county region.

Average earnings per job in the three-county region would be expected to fall as employment in the PAPA declines. The average earnings per job for those employed in drilling (2007 through 2025) would be $51,291, and for production (2007 through 2065), it would be $52,243. This exceeds the average earnings per job in Lincoln County ($30,438), in Sublette County

($31,715), and in Sweetwater County ($38,698). Therefore, employment in the PAPA would raise wage levels in the three-county region from 2007 through 2065, and in particular, in the years when drilling occurs (2007-2025).

Leading up to 2065, local government revenues from PAPA production would drop, shifting the tax burden away from the oil and gas industry and toward Sublette County residents for provision of infrastructure and amenities. From 2007 through 2065, increased revenues from PAPA taxes and royalties to the City of Pinedale and Sublette County would allow greater local government provision of amenities and infrastructure (including schools). Because the percentage of Sublette County property taxes that is contributed to local governments from oil and gas production is high, the mil levy for property taxes paid by residents would be proportionally smaller than it would without development in the PAPA.

4.3.4 Cumulative Impacts

Lincoln, Sublette, and Sweetwater counties comprise the CIAA for socioeconomics. This three-county region depends upon the oil and gas industry for a portion of their economic activity and tax base (see Table 3.5-2 and Table 3.5-8). Ongoing development of the PAPA, along with other oil and gas development, is correlated with increased employment opportunities, higher paying employment opportunities, expanded tax base, and support for the ability of local government to maintain and increase services and infrastructure. Wells developed in the PAPA add proportionately to the economic benefits in the three-county region.

Increases in regional oil and gas development activity over a short period can cause notable changes in employment and income, including the boom/bust cycles mentioned during scoping. Changes in employment and income trigger impacts on community services, social structures, and lifestyles. Wyoming, particularly the three-county region, is highly dependent on mineral revenues, and the revenue from natural gas development in the PAPA would add to these revenues.

4.3.5 Alternative Impact Mitigation

The PAPA DEIS (BLM, 1999a) identified several mitigation measures that would offset the impact to Socioeconomic Resources. However, BLM and the cooperating agencies lack jurisdiction to impose many of the identified measures and none were carried forward into the PAPA ROD (BLM, 2000b). Any mitigation to offset impacts to Socioeconomic Resources would be strictly voluntary by the Operators.

4.4 TRANSPORTATION

4.4.1 Scoping Issues

Increased traffic volume and associated safety risks were concerns received during scoping including:

1. Evaluate further efforts to reduce traffic by busing, stockpiling, or convoys.
2. Concern over increased safety risks on local and county roads with winter drilling and increased winter traffic.

4.4.2 Impacts Considered in the PAPA DEIS

In 1999, the PAPA DEIS (BLM, 1999a) stated that potential impacts from all of the alternatives, except the *No Action Exploration/Development Scenario*, could include the following:

- increased traffic volume on area highways and roads;

- accelerated deterioration of road surfaces;
- increased road maintenance requirements because of increased traffic;
- increased off-road vehicle use, use of two-tracks, and access to sensitive areas;
- increased likelihood of traffic accidents, vehicle-person, and vehicle-animal collisions;
- increased access to sensitive areas during winter months while big game is abundant and potentially stressed; and
- increased speeding.

The PAPA DEIS (BLM, 1999a) specified that impacts under the alternatives would be significant if the following occurred:

- increased traffic levels on U.S. Highway 191 or State Highway 351 cause a decrease in level of service as defined by the Wyoming Department of Transportation;
- project related traffic conflicts with existing residential use; or
- project related traffic would accelerate the deterioration and related maintenance costs of area roads beyond those scheduled by the responsible agency.

The PAPA DEIS (BLM, 1999a) recognized potential conflict between extensive development in the north end of the PAPA near Pinedale and project related traffic and dust adjacent to the Pinedale South and Mesa roads. The project related traffic could cause significant impacts to residents and recreation use. Subdivisions and subdivided lands are located adjacent to these roads. Residential streets through the Town of Pinedale provide easy access to the Pinedale South Road. Local residents use areas along roads near and west of the New Fork River for recreation (i.e., walking, jogging, bicycling, etc).

Many of the roads in the PAPA were not designed for the loads they currently support. Increased development traffic would result in further and accelerated deterioration of these roads. Accelerated deterioration of county road surfaces is expected to cause significant impacts.

Based on the significance criteria in the PAPA DEIS (BLM, 1999a), there have been significant negative impacts to Transportation Resources by existing development in and near the PAPA. Increased traffic levels on U.S. Highway 191 caused a decrease in the Level of Service (see Section 3.6.1.1). Project related traffic has conflicted with existing residential use and has accelerated the deterioration and related maintenance costs of area roads.

4.4.3 Alternative Impacts

4.4.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Each of the alternatives would require additional construction of local and resource roads to access new well pads and other wellfield components. Arterial and collector roads are assumed to remain constant during future development in the PAPA.

Direct impact to Transportation Resources includes increased traffic in the PAPA. Each of the alternatives would require additional traffic throughout the year during construction of new well pads, drilling, completions, and production. Estimates of projected daily traffic volumes in the

PAPA under the No Action Alternative and Proposed Action Alternative were provided by the Operators for summer 2009 (Table 4.4-1) and winter 2009 (Table 4.4-2). Traffic estimates under Alternative C are assumed to be similar to traffic estimates for the Proposed Action

Table 4.4-1
Projected Traffic Volume in the PAPA (vehicles per day)
During Development for all Alternatives in Summer 2009[1]

Wellfield Development	No Action Alternative			Proposed Action Alternative and Alternative C		
	Light Vehicles	Heavy Vehicles	Total Vehicles	Light Vehicles	Heavy Vehicles	Total Vehicles
Well Pad Construction [2]	65	97	162	49	73	122
Road Construction [3]	17	26	43	12	18	30
Gathering Pipeline Construction [4]	59	89	148	40	61	101
Rig Moves [5, 6]	7	20	27	2	6	8
Drilling [7, 8]	410	273	683	251	251	502
Completion [9, 10]	342	228	570	100	150	250
Production Activities [11, 12]	1,059	0	1,059	168	0	168
Liquids Removal [13, 14]	0	301	301	0	36	36
Total	1,959	1,034	2,993	622	595	1,217

[1] Assumes 183 days of summer construction.
[2] Assumes 400 vehicles per pad, 160 light vehicles and 240 heavy vehicles. In 2009, there are 54 new pads and 20 expanded pads (74 pads total) by the No Action Alternative and 37 new pads and 19 expanded pads (56 pads total) by the Proposed Action (and Alternative C).
[3] Assumes 88 heavy vehicles and 58 light vehicles per new pad constructed. In 2009, assumes 54 new pads by the No Action Alternative and 37 new pads by the Proposed Action (and Alternative C).
[4] Assumes 300 heavy vehicles and 200 light vehicles per new pad constructed.
[5] Assumes 8.8 light vehicles and 26.3 heavy vehicles per well drilled. In summer 2009, assumes 139 wells drilled by the No Action Alternative over 183 days.
[6] Assumes 2.2 light vehicles and 6.6 heavy vehicles per well drilled. Assumes 305 wells drilled over 365 days in 2009 by the Proposed Action and Alternative C.
[7] Assumes 360 heavy vehicles and 540 light vehicles per well drilled. In summer 2009, assumes 139 wells drilled by the No Action Alternative over 183 days.
[8] Assumes 300 heavy vehicles and 300 light vehicles per well drilled. Assumes 305 wells drilled over 365 days in 2009 by the Proposed Action and Alternative C.
[9] Assumes 300 heavy vehicles and 450 light vehicles per well completed. Assume 139 wells drilled by the No Action Alternative over 183 days.
[10] Assumes 180 heavy vehicles and 120 light vehicles per well completed. Assumes 305 wells drilled over 365 days in 2009 by the Proposed Action and Alternative C.
[11] Assumes 1,246 producing wells at mid year 2009. Assumes 0.85 light vehicles per day per well by the No Action Alternative.
[12] Assumes 1,342 producing wells at mid year 2009. Assumes 0.125 light vehicles per day per well by the Proposed Action and Alternative C.
[13] Assumes 10,755,765 bbl water removed in 2009 and 4,639,513 bbl oil removed (Shell and Ultra only plus 5 percent added for other operators). Assumes one heavy vehicle per 140 bbls of water removed and one heavy vehicle per 140 bbls of oil removed by the No Action Alternative.
[14] Assumes 10 percent of water and oil is trucked. Assumes one heavy vehicle per 140 bbls of water removed and one heavy vehicle per 140 bbls of oil removed by the Proposed Action and Alternative C.

Table 4.4-2
Projected Traffic Volume in the PAPA (vehicles per day) during Development for all Alternatives in Winter 2009[1]

Wellfield Development	No Action Alternative			Proposed Action Alternative and Alternative C		
	Light Vehicles	Heavy Vehicles	Total Vehicles	Light Vehicles	Heavy Vehicles	Total Vehicles
Well Pad Construction	N/A	N/A	N/A	N/A	N/A	N/A
Road Construction	N/A	N/A	N/A	N/A	N/A	N/A
Gathering Pipeline Construction	N/A	N/A	N/A	N/A	N/A	N/A
Rig Moves [2, 3]	5	14	19	2	6	6
Drilling [4, 5]	286	191	477	251	251	502
Completion [6, 7]	239	159	398	100	150	250
Production Activities [8, 9]	1,059	0	1,059	168	0	168
Liquids Removal [10, 11]	0	301	301	0	36	36
Total	1,589	665	2,254	521	443	964

[1] Assumes 183 days of winter.
[2] Assumes 8.8 light vehicles and 26.3 heavy vehicles per well drilled. In winter 2009, assumes 97 wells drilled by the No Action Alternative over 183 days.
[3] Assumes 2.2 light vehicles and 6.6 heavy vehicles per well drilled. Assumes 305 wells drilled over 365 days in 2009 by the Proposed Action and Alternative C.
[4] Assumes 360 heavy vehicles and 540 light vehicles per well drilled. In winter 2009, assumes 97 wells drilled by the No Action Alternative over 183 days.
[5] Assumes 300 heavy vehicles and 300 light vehicles per well drilled. Assumes 305 wells drilled over 365 days in 2009 by the Proposed Action and Alternative C.
[6] Assumes 300 heavy vehicles and 450 light vehicles per well completed. Assumes 97 wells drilled by the No Action Alternative over 183 days.
[7] Assumes 180 heavy vehicles and 120 light vehicles per well completed. Assumes 305 wells drilled over 365 days in 2009 by the Proposed Action and Alternative C.
[8] Assumes 1,246 producing wells at mid year 2009. Assumes 0.85 light vehicles per day per well by the No Action Alternative.
[9] Assumes 1,342 producing wells at mid year 2009. Assumes 0.125 light vehicles per day per well by the Proposed Action and Alternative C.
[10] Assumes 10,755,765 bbl water removed in 2009 and 4,639,513 bbl oil removed (Shell and Ultra only plus 5 percent added for other operators). Assumes 1 heavy vehicle per 140 bbls of water removed and 1 heavy vehicle per 140 bbls of oil removed by the No Action Alternative.
[11] Assumes 10 percent of water and oil is trucked. Assumes 1 heavy vehicle per 140 bbls of water removed and 1 heavy vehicle per 140 bbls of oil removed by the Proposed Action and Alternative C.

Alternative. Assumptions for estimating traffic are based on projected number of well pads, wells drilled, producing wells, and production of condensate and water.

There would be a reduction in wellfield traffic once all wells have been drilled and are in production. Installation of a liquids gathering system in the northern portion of the PAPA has reduced daily traffic to producing wells. Under the Proposed Action and Alternative C, a liquids gathering system would be installed in the central and southern portions of the PAPA, thereby further reducing production related traffic. However, the level of traffic related to drilling far exceeds any reduction realized by installation and use of liquids gathering systems in big game crucial ranges in winter and during all seasons. The liquids gathering system in the central and southern portions of the PAPA would not be installed under the No Action Alternative.

Increased rates of vehicular accidents on roads adjacent to the PAPA (direct impact by wellfield development) have increased with increased traffic volumes (see Chapter 3 – Transportation).

Assuming that increased traffic volume contributes to the possibility of vehicular accidents, higher accident rates are expected with implementation of any of the alternatives, although higher accident rates would continue longer under the Proposed Action Alternative and Alternative C through 2011 than under the No Action Alternative. Increased traffic volume would be similar under the Proposed Action Alternative and Alternative C through 2023.

As discussed in Chapter 3, highway maintenances costs borne by WDOT have increased and in September 2006, the U.S. Department of Transportation cut more than $27 million in highway funds for Wyoming that had already been appropriated (Neary, 2006). Reduced federal funding would limit highway maintenance opportunities on roads used to access the PAPA. Increased traffic in the PAPA would accelerate deterioration of area roads beyond the maintenance capabilities of the responsible agency.

The significant impacts to transportation that have already been realized are expected to continue to occur under all of the alternatives through 2023 during wellfield development. Once all wells are producing and development is complete, impacts would be reduced.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Construction of the proposed pipelines (estimated 3 to 5 months duration) would result in increases in traffic, both heavy and light vehicles, on federal and state highways and county and BLM/BOR roads. There is a potential for corresponding short-term increase in accidents along the highways and roads providing access to the pipeline construction locations. However, observance of highway safety rules, regulations, and practices would reduce this potential. Pipeline construction would comply with permit requirements from state, county, and BLM/BOR to ensure that roads are repaired after construction and that there is adequate traffic control to protect the traveling public. Detour (shoe-fly) roads would be constructed and temporarily maintained at existing road crossings to prevent disruption of use. Traffic associated with pipeline operations would be minimal.

4.4.3.2 Alternative A (No Action Alternative)

There would be an estimated 108 miles of roads constructed in the PAPA, through 2011, under the No Action Alternative. The Operators expect to construct 245 new well pads and expand 92 existing pads by 3 to 16 acres each. New roads are not required for expansion pads.

After 2006, under the terms of BLM’s 2004 Decision Record (BLM, 2004a), there is a limitation of two additional well pads allowed within the mostly single Operator contiguous leasehold in the northern portion of the PAPA (currently operated by Questar). The limitation on new well pad construction is included in the No Action Alternative. Consequently, most new wellfield roads under the No Action Alternative would be constructed in the central and southern portions of the PAPA. Winter drilling would be allowed within the mostly single Operator contiguous leasehold in the northern portion of the PAPA (November 15 though April 30) in mule deer crucial winter range with up to six drilling rigs, two rigs per well pad, each year through 2011. Liquids gathering systems have been installed within this leasehold and would continue to be installed under the No Action Alternative. Traffic to producing wells within this leasehold is estimated to be 0.7 vehicle per day per producing well (see Table 3.6-5), based on winter 2005-2006 data. Traffic related to winter drilling would probably exceed 66 vehicles per day to each pad location.

No development related traffic would occur on big game crucial winter ranges in the central and southern portions of the PAPA between November 15 and April 30, however, production related traffic would continue through each winter. The No Action Alternative does not include construction of additional liquids gathering systems in the central and southern portions of the PAPA. Without a gathering system, estimated traffic to producing wells would be approximately 1.6 vehicles per day per producing well (see Table 3.6-5), based on winter 2005-2006 data.

Operators with leaseholds outside of big game crucial winter ranges could continue year-round drilling with traffic similar to the estimate made for the mostly single Operator contiguous leaseholds in the northern portion of the PAPA. Impacts associated with increases in traffic volume, accident rates, road surface deterioration, and maintenance costs would continue under the No Action Alternative.

4.4.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

Under the Proposed Action Alternative, 2007 through 2011, there would be an estimated 89 miles of roads, nearly 20 miles less than under the No Action Alternative. Under the Proposed Action Alternative, Operators expect to construct 179 new well pads rather than 245 well pads under the No Action Alternative, resulting in fewer road miles. Under the Proposed Action Alternative, 116 existing well pads would be expanded by the end of 2011; however, new access roads are not required for expansion pads.

Under the Proposed Action Alternative, well drilling on all new pads and expanded pads within a CDA (Map 4.1-3) would occur year-round even on pads within big game crucial winter ranges. Consequently, vehicular traffic related to drilling and completions during winter would be substantially greater through 2011 under the Proposed Action Alternative compared to traffic under the No Action Alternative.

Under the Proposed Action Alternative, a liquids gathering system would be installed in the central and southern portions of the PAPA within 2 years of the issuance of the ROD. Use of liquids gathering systems and increased use of computer assisted remote monitoring would reduce daily traffic to producing wells in winter as well as in other seasons. The amount of traffic reduced during winter months by use of the liquids gathering system would not compensate for traffic generated by development (drilling and completions) during winter. Consequently, impacts associated with traffic volume, accident rates, road surface deterioration, and maintenance costs would increase, particularly during winter, under the Proposed Action Alternative.

Proposed Action Alternative Through 2023

Through 2023, the Proposed Action Alternative would require an estimated total of 121 miles of new roads. Under this alternative, 250 new well pads would be constructed through 2017 and therefore, no new roads would be constructed after 2017. In addition to new pads, 264 existing well pads would be expanded through 2023. New access roads are not required for expansion of existing pads.

Under the Proposed Action, well drilling within the Operators' collective CDAs would continue on a year-round basis even within big game crucial winter ranges. Winter drilling would continue, although on fewer and fewer well pads each year, through 2023. Winter traffic in the PAPA would similarly decline, most noticeably after 2017. Impacts associated with traffic volume, accident rates, road surface deterioration, and maintenance costs would increase through 2017. These impacts would gradually decrease after 2017 and through 2023 with the steady decline in winter traffic and development related traffic in general.

4.4.3.4 Alternative C

Alternative C Through 2011

Under Alternative C, through 2011, the number of new well pads, existing pads expanded, and miles of new roads would be the same as under the Proposed Action Alternative through 2011. In 2011, the distribution of new roads constructed under Alternative C would differ from the distribution of new roads constructed under the Proposed Action Alternative. Under Alternative C, new road construction would be concentrated in the southern 2 miles of DA-1, within DA-2, and throughout DA-4 (Map 4.1-4). Access to those development areas during winter would be from the south, along Paradise Road and the North Anticline Road, similar to access under the No Action and Proposed Action alternatives.

No new roads are likely to be constructed in DA-3 through 2011 under Alternative C or until development is complete in DA-2. Consequently, winter traffic would be production related. A liquids gathering system would be installed to each producing well in DA-3 within 2 years of issuance of the ROD, further reducing winter traffic. Increased use of computer assisted remote monitoring would reduce traffic during all seasons. Access during winter could be limited to either the Boulder South Road or South Anticline Road. Access to year-round drilling in DA-4 would probably be from Highway 351 and the Jonah North Road. Under Alternative C, impacts associated with increasing traffic volume, including accident rates, road surface deterioration, and maintenance costs would be more restricted, particularly during winter under Alternative C than under the Proposed Action Alternative.

<u>Alternative C Through 2023</u>

Similar to the Proposed Action Alternative 250 new well pads and 121 miles of new roads would be constructed through 2017, the year the last new well pad would be constructed under Alternative C. Like the Proposed Action Alternative, 264 existing well pads would be expanded, although no new roads would be constructed for expansion pads.

As development in the southern portion of DA-1 is completed, development would move to the north within the mostly single Operator contiguous leasehold. By 2017, development in DA-1 would be concentrated on the north end of DA-1. By 2017 and through 2023, winter drilling on big game crucial winter range would be limited to the north end of DA-1. Access to wellfield development during winter on the north end would be from the north, rather than from the south along the North Anticline Road. Development of a transportation plan for access from the north is pending. BLM is currently working with Sublette County, WGFD, and local landowners in identifying an access route from the north. Production activity in all crucial winter range would use access closest to any paved road from producing wells so that the limited traffic required to access producing wells in the southern end of DA-1 would be from the south.

Once all year-round drilling and wellfield development has been completed within DA-2, wellfield development would commence in DA-3. With no additional winter drilling allowed in DA-2, access into DA-2 would be related to production. Liquids gathering systems would be in place so the production related traffic volumes to DA-2 would be minimal, at rates that would be expected to continue through the life of the project. Access would be from the Boulder South Road.

Once development moves into DA-3, traffic would increase substantially due to year-round drilling. The traffic may be limited to entering the area from Highway 351 and the South Anticline Road rather than from the Boulder South Road which would be closed during winter to limit traffic within big game crucial winter ranges.

Development would probably continue in DA-4 and extend into DA-5. Once there, however, Operators would be restricted by seasonal limitations on drilling between March 1 and July 15 (BLM, 2004c) to protect greater sage-grouse leks and nesting habitats. In DA-5, traffic volume resulting from implementation of Alternative C would be similar to traffic associated with the Proposed Action Alternative. With the steady decline in winter traffic and development related traffic after 2017, impacts associated with traffic volume, including accident rates, road surface deterioration and maintenance costs would gradually decrease through 2023 under Alternative C, similar to declines under the Proposed Action.

4.4.4 Cumulative Impacts

Cumulative impact from project related traffic is considered in combination with other regional development within the CIAA. The CIAA includes secondary roads and major highways within and adjacent to the PAPA. Any additional traffic would increase the disturbance of wildlife, potential for accidents, and the needs for maintenance and dust control. Installation of liquids gathering systems in the central and southern portions of the PAPA, under the Proposed Action Alternative and Alternative C, would reduce liquid haulage traffic compared to the No Action Alternative, but this is a small impact compared to the overall drilling and development traffic.

Costs of road maintenance would be partly supported by county taxes from Operators, and partly from state revenues. Increasing maintenance costs, uncertain funding, and increased traffic by any of the alternatives and other developments in the region are likely to put more responsibility for maintenance of drilling access roads on Operators, and could lead to deterioration of main roads.

While some cumulative impact on transportation may be positive (increased availability of roads and improved road conditions in the PAPA), the overall cumulative impact is likely to be negative for the reasons noted.

4.4.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to Transportation Resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM’s Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.5 LAND USE AND RESIDENTIAL AREAS

4.5.1 Scoping Issues

The following concerns related to land uses in the PAPA were received during scoping:

1. Address impacts to ranchers and private property owners from wildlife displaced to their lands by development.
2. Concern that multiple use objectives on BLM land are being overlooked.
3. Concern that operators are industrializing nonfederal lands to avoid restrictions on BLM land.

4.5.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM recognized with new development in the PAPA, land use would change because oil and gas activities would become the dominant land use under full development and would preclude or interfere with other land uses. It recognized that the PAPA was valued for its open space and as a place of solitude. Some of the area was inaccessible by vehicles, and in some areas it was difficult to find evidence of human activity. In 1999, the views from most of the PAPA, particularly the Mesa, were exceptional with the Wind River Range to the east and the Wyoming Range to the west. The views were compared to current views available from the adjacent Jonah II Field:

> *"While the views are equally as dramatic in the Jonah II Field, the sense of openness and solitude have been lost. In that portion of the Jonah II Field currently being developed, one is constantly aware that extensive development activities are ongoing. This is not a criticism of oil and gas development but rather a recognition of the difference in the feeling of open space and solitude between the two areas."*

Because it was impossible to predict where economically recoverable of oil and gas reserves occur in the PAPA, it was not possible to predict where the changes in open space and solitude would occur. The PAPA DEIS (BLM, 1999a) concluded, wherever development would occur, those characteristics of the landscape would be lost.

The PAPA DEIS (BLM, 1999a) specified that significant impacts to land use would result from project related activities if those activities:

- were incompatible with land use ordinances, plans, regulations or controls;
- adversely affected other existing and legitimate land uses; or
- adversely affected the use, enjoyment or value of adjacent property or introduce safety and health risks or a nuisance or annoyance to an area where such risks, nuisance, or annoyance did not previously exist.

The PAPA DEIS (BLM, 1999a) predicted significant impacts to land use from all of the alternatives except the *No Action Exploration/Development Scenario*. The significant impacts to land use in the PAPA that were predicted in 1999 have occurred.

In addition to values of open space and solitude, the PAPA DEIS (BLM, 1999a) considered that extensive development on many of the private parcels of land in the PAPA would not be compatible with their zoned use as established by the Sublette County Zoning and Development Regulations. Conflicts were expected to occur between wellfield development and residential uses. The *Resource Protection Alternative on Federal Lands and Minerals* specified that placement of well pads on federal lands and minerals within 0.25 mile of occupied dwellings would be avoided, according to BLM Mitigation Guidelines. On private and state lands and minerals, well pads could be placed as close as 350 feet from occupied dwellings. BLM expanded the 0.25-mile buffer to include areas zoned for residential use by Sublette County and subdivisions and subdivided lands, thus avoiding placement of well pads within the entire Residential Area SRMZ.

4.5.3 Alternative Impacts

4.5.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Impacts to land use and residential areas, similar to those predicted in the PAPA DEIS (BLM, 1999a), have occurred during wellfield development since issuance of the PAPA ROD (BLM, 2000b). While the PAPA had been valued for its open space and as a place of solitude, the view within the Anticline Crest more resembles the Jonah II Field in 1999. Land uses associated with open space, principally recreation, livestock grazing, and wildlife habitat have changed to an industrial landscape.

A comparison of potential surface disturbance by land use/land cover type by 2011 under the alternatives show differences in the affected areas (Table 4.5-1). Total disturbance by 2011 would be greater under the Proposed Action Alternative and Alternative C than under the No Action Alternative. However, surface disturbance under the No Action Alternative may be randomly spread across the Anticline Crest while both the Proposed Action Alternative and Alternative C include concentrated development and restrictions on where disturbance could occur, at least in winter. By 2023, the land use/land cover types affected would be similar under the Proposed Action Alternative and Alternative C.

Table 4.5-1
Surface Disturbance in Relation to Land Use/Land Cover Types by Alternative

Land Use/Land Cover Type	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Cropland and Pasture	142.1	161.0	198.1	307.1	387.4	319.9
Forested Wetlands	25.2	30.3	45.2	45.1	185.3	166.9
Herbaceous Rangeland	13.9	0.4	0.4	0.4	9.3	1.9
Industrial	10.0	5.1	6.3	4.3	10.0	12.5
Mixed Rangeland	81.1	120.1	178.9	103.6	264.3	212.4
Nonforested Wetlands	111.6	126.8	106.8	125.6	239.3	215.2
Reservoirs	0.0	0.0	0.0	0.0	0.0	0.0
Residential	3.4	0.6	0.0	0.0	0.0	0.0
Sandy Areas other than Beaches	6.1	0.0	0.2	0.2	0.2	0.7
Shrub and Brush Rangeland	4,661.6	4,040.2	6,308.7	6,269.9	11,182.2	11,341.7
Mines, Quarries and Gravel Pits	0.6	0.0	0.4	0.4	0.4	0.4
Transitional Areas	0.6	0.0	0.0	0.0	0.0	0.0
Transportation, Communication, Utilities	3.2	0.0	0.0	0.0	0.0	0.0
Total	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**

Implementation of any of the alternatives would continue to change the characteristics of most land use/land cover types (see Table 4.5-1) to a landscape where "*one is constantly aware that extensive development activities are ongoing*." As stated above, the potential significant impacts to land use predicted in the PAPA DEIS (BLM, 1999a) have occurred and would continue to occur under all of the alternatives.

Table 4.5-2 shows that wellfield development under any of the alternatives would have minimal impact to lands zoned as Residential by Sublette County. However, there would be disturbance within the Residential SRMZ by each alternative including new wellfield disturbance expected within the 0.25-mile buffer surrounding residences (Table 4.5-2). This occurs because many residences, and therefore the 0.25-mile buffer, are outside of the areas zoned Residential by Sublette County.

All alternatives are expected to result in substantial additional surface disturbance on lands zoned as both Agriculture and Resource Conservation by Sublette County (Table 4.5-2). While the county's zoning districts include federally administered lands, the county has no jurisdiction on these lands.

Table 4.5-2
Surface Disturbance in Relation to Sublette County Zoning Districts and the Residential SRMZ by Alternative

Sublette County Zoning District	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Agricultural	1,119.7	934.1	1,147.2	1,313.1	2,454.2	2,233.8
Highway Commercial	0.5	0.0	0.0	0.0	0.0	0.0
Heavy Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Light Industrial	6.6	0.0	0.0	0.0	0.0	0.0
Rural Residential	11.9	0.0	0.0	0.0	0.0	0.0
Rural Residential 10	5.6	0.0	0.0	0.0	0.0	0.0
Rural Residential 20	0.7	0.0	0.0	0.0	0.0	0.0
Rural Residential 5	2.2	0.0	0.1	0.1	0.1	0.1
Rural Residential Mobile/Manufactured Home 10	0.0	0.0	0.0	0.0	0.0	0.0
Resource Conservation	3,912.2	3,550.4	5,697.7	5,543.4	9,824.1	10,037.7
Rural Mixed	0.0	0.0	0.0	0.0	0.0	0.0
Total in Zoning Districts	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**
0.25-mile Residence Buffer	123.6	54.3	109.9	184.8	249.1	202.8
Residential SRMZ	145.5	103.1	154.7	229.6	294.2	247.8

Pipeline Corridors and Gas Sales Pipelines

The principal land uses along the proposed corridor/pipeline alignments are livestock grazing, wildlife habitat and oil and gas development. Establishment of the proposed corridors and construction and operation of pipelines within the corridors would not preclude the current land uses. The proposed corridors represent a proposed expansion of either adjacent or nearby pipeline corridors that connect the PAPA and the Jonah Field Project Area with gas plants in southwestern Wyoming. Designation of the corridors would be consistent with past, current, and continued uses of the lands. No changes in land use or conflicts with county zoning regulations are expected as a result of either designation of the corridors or construction and operation of the proposed pipelines.

4.5.3.2 Alternative A (No Action Alternative)

Implementation of the No Action Alternative would affect Resource Conservation and Agricultural zoning districts with an expected disturbance of approximately 3,550 acres and 934 acres, respectively (Table 4.5-2). Wellfield development under the No Action Alternative would increase surface disturbance inside the Residential SRMZ and 0.25-mile residential buffer by more than 100 acres, primarily near residences along the New Fork River.

Although development under the No Action Alternative would be compatible with county zoning in the several rural residential categories, the development would be in conflict with the intended use of lands zoned as Resource Conservation in which protection and conservation of environmentally sensitive areas must be limited to prevent degradation (Sublette County, 2002). It is unknown if planned development under the No Action Alternative, within the Residential SRMZ and 0.25-mile residential buffer, would adversely affect the use, enjoyment or value of adjacent property or introduce safety and health risks or a nuisance or annoyance to the areas.

4.5.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

Compared to the No Action Alternative, implementation of the Proposed Action Alternative through 2011 would result in more overall disturbance (6,845 acres) than the No Action Alternative. Map 4.1-3 shows that wellfield development under the Proposed Action Alternative through 2011 would be concentrated on the Anticline Crest rather than distributed throughout the PAPA. Wellfield development by the Proposed Action Alternative through 2011 would affect the Residential SRMZ more than the No Action Alternative, but less than Alternative C by 2011.

Proposed Action Alternative Through 2023

By 2023, the Proposed Action Alternative is expected to increase existing surface disturbance by nearly 12,300 acres. Of that, more than 11,000 acres of surface disturbance would be in Shrub and Brush Rangeland (Table 4.5-1). Depending on how successful future revegetation efforts would be during the 17-year period of wellfield development, the PAPA (Anticline Crest) might or might not appear as an industrialized landscape, such as it is in 2006.

By 2023, the Proposed Action Alternative would likely increase existing surface disturbances within the Resource Conservation zoning district by more than 9,800 acres. Wellfield development under the Proposed Action Alternative is expected to affect the Residential SRMZ by less than 300 acres in 2023, and would be similar to that disturbed by Alternative C by 2023.

4.5.3.4 Alternative C

Alternative C Through 2011

Implementation of Alternative C through 2011 would result in about the same level of disturbance (6,856 acres) as the Proposed Action Alternative through 2011; however, the level of disturbance under both alternatives would be greater than under the No Action Alternative. Most new wellfield development under Alternative C would be within Shrub and Brush Rangeland by 2011 (Table 4.5-1). Map 4.1-4 shows that future development under Alternative C through 2011 would be concentrated on the Anticline Crest rather than distributed throughout the PAPA.

Unlike the No Action Alternative and the Proposed Action Alternative, initially, there would not be any new surface disturbance within the northern portion of DA-1 and within DA-3 in winter. Initially, there would be considerably more surface disturbance in the southern portion of DA-1 and in DA-2 than under the Proposed Action Alternative because of the restricted development in DA-1 and DA-3 under Alternative C. The differential is evident in Table 4.5-1 by more disturbance in the Cropland and Pasture land use/land cover category and in Table 4.5-2 by more disturbance within lands zoned as Agricultural under Alternative C through 2011 than under the Proposed Action through 2011.

Wellfield development under Alternative C is expected to affect the Residential SRMZ slightly more under Alternative C through 2011 than under the No Action Alternative, but more than the Proposed Action Alternative by 2011.

<u>Alternative C Through 2023</u>

By 2023, Alternative C is expected to increase existing surface disturbance by nearly 12,300 acres, similar to the Proposed Action Alternative (Table 4.5-1).

Alternative C specifies that wellfield development would progress from south to north in D-1 and from DA-2 to DA-3, during winter. With wellfield development completed in development areas before new areas could be developed (at least during winter), there is the potential for not just interim reclamation, but final reclamation in these areas. That possibility does not exist under the Proposed Action Alternative because the CDAs would be allowed to move north and south within the core area.

Similar to the Proposed Action Alternative by 2023, wellfield development under Alternative C by 2023 would increase existing surface disturbance within the Resource Conservation zoning district by 10,037 acres. Wellfield development by Alternative C through 2023 is expected to affect the Residential SRMZ by approximately 250 acres, similar to the Proposed Action Alternative through 2023.

4.5.4 Cumulative Impacts

The CIAA for land use/residential areas is confined to the PAPA. Land use within Sublette County was changing before 1999 from an area of open spaces associated with agriculture, wildlife habitat, dispersed recreation, and overall low densities of development – including residential, urban, and natural resource extraction by oil, natural gas, and mining industries (McLeod et al., 1998). Prior to issuance of the PAPA ROD (BLM, 2000b), most of the native landscape in the PAPA had been changed by agricultural use.

The cumulative surface disturbance to land use/land cover types by alternative (Table 4.5-3) was calculated by adding the existing non-wellfield disturbance, the existing wellfield disturbance and the projected surface disturbance by each alternative. The portion of the surface disturbance in the PAPA projected for the gas sales pipelines is also included in Table 4.5-3 under each alternative.

Total cumulative surface disturbance by the Proposed Action Alternative and Alternative C through 2011 exceeds cumulative effects by the No Action Alternative. The difference in level of cumulative impact among the alternatives is most apparent in the effects to Shrub and Brush Rangeland. Although cumulative effects to Cropland and Pasture appear substantial by each alternative in Table 4.5-3, it is only a reflection of the existing agricultural development.

Cumulative impact to Sublette County Zoning Districts is based on past, present, and future levels of surface disturbance (Table 4.5-4) for which the vast majority of impact is within the Resource Conservation zoning district. There would be cumulative impact to the Agricultural Zoning District by each alternative as well, but 5,458 acres of that is due to agricultural land use in that district, the reason for the lands being zoned Agricultural by Sublette County. Even so, there is existing wellfield development (1,120 acres) and future development that would transform the district to some degree from current zoning.

Table 4.5-3
Cumulative Surface Disturbance in Relation to Land Use/Land Cover Types by Alternative

Land Use/Land Cover Type	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Cropland and Pasture	4,111.8	142.1	4,421.8	4,458.9	4,567.9	4,648.2	4,580.7
Forested Wetlands	5.8	25.2	64.9	79.8	79.7	219.9	201.5
Herbaceous Rangeland	589.7	13.9	604.0	604.0	604.0	612.9	605.5
Industrial	0.0	10.0	16.5	17.7	15.7	21.4	23.9
Mixed Rangeland	23.6	81.1	231.0	289.8	214.5	375.2	323.3
Nonforested Wetlands	598.1	111.6	851.9	831.9	850.7	964.4	940.3
Reservoirs	12.2	0.0	12.2	12.2	12.2	12.2	12.2
Residential	97.8	3.4	101.8	101.2	101.2	101.2	101.2
Sandy Areas Other than Beaches	0.0	6.1	6.1	6.3	6.3	6.3	6.8
Shrub and Brush Rangeland	1,896.6	4,661.6	10,991.2	13,259.7	13,220.9	18,133.2	18,292.7
Mines, Quarries and Gravel Pits	0.0	0.6	0.0	0.4	0.4	0.4	0.4
Transitional Areas	0.0	0.6	0.6	0.6	0.6	0.6	0.6
Transportation, Communication, Utilities	131.3	3.2	134.5	134.5	134.5	134.5	134.5
Total	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**

While existing, non-wellfield disturbance has generated only a minor amount of disturbance within the Resource Conservation zoning district in the PAPA, the majority of existing wellfield development has been concentrated in the Resource Conservation zoning district and development by all of the alternatives is expected there as well. Compared to the No Action Alternative, there would be far more cumulative impact to the Resource Conservation zoning district by the Proposed Action Alternative and Alternative C through 2011 (Table 4.5-4). Under the Proposed Action through 2023, cumulative impact to the Resource Conservation zoning district would be similar to Alternative C.

Existing non-wellfield surface disturbance within the Residential SRMZ and 0.25-mile residence buffer in Table 4.5-4 are from residences and associated infrastructure, mostly roads that were originally used to define the two land use components in the PAPA DEIS (BLM, 1999a). While the impact to each one by present and future wellfield development in the PAPA is not small, the relatively large amount of surface disturbance by each alternative is the result of including existing residential land uses in the cumulative area of surface disturbance for each alternative. Under the No Action Alternative, cumulative impact to the Residential SRMZ and 0.25-mile buffer would be less than under the Proposed Action Alternative and Alternative C through 2011. Cumulative impact to the Residential SRMZ and 0.25-mile residential buffer would be similar under the Proposed Action Alternative and Alternative C through 2023.

Table 4.5-4
Cumulative Surface Disturbance in Relation to
Sublette County Zoning Districts and the Residential SRMZ by Alternative

Sublette County Zoning District	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Agricultural	5,458.2	1,119.7	7,616.1	7,829.2	7,995.1	9,136.2	8,915.8
Highway Commercial	14.1	0.5	14.6	14.6	14.6	14.6	14.6
Heavy Industrial	36.8	0.0	36.8	36.8	36.8	36.8	36.8
Light Industrial	259.4	6.6	266.0	266.0	266.0	266.0	265.9
Rural Residential	1,024.6	11.9	1,036.5	1,036.5	1,036.5	1,036.5	1,036.5
Rural Residential 10	129.0	5.6	134.6	134.6	134.6	134.6	134.6
Rural Residential 20	142.7	0.7	143.4	143.4	143.4	143.4	143.4
Rural Residential 5	6.4	2.2	8.6	8.7	8.7	8.7	8.7
Rural Residential Mobile/Manufactured Home 10	33.7	0.0	33.7	33.7	33.7	33.7	33.7
Resource Conservation	345.8	3,912.2	8,130.6	10,277.9	10,123.6	14,404.3	14,618.0
Rural Mixed	16.2	0.0	16.2	16.2	16.2	16.2	16.2
Total in Zoning Districts	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**
0.25-mile Residence Buffer	2,330.3	123.6	2,508.2	2,563.8	2,638.7	2,703.0	2,656.7
Residential SRMZ	3,739.9	145.5	3,988.5	4,040.1	4,115.0	4,179.6	4,133.2

4.5.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to land use and residential areas would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.6 RECREATION RESOURCES

4.6.1 Scoping Issues

Concerns regarding potential impacts to recreation received during public scoping include:

1. Concern that hunting has been affected because wildlife populations have declined.
2. Removal of winter restrictions on drilling will impact the hunting and fishing communities.

4.6.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM assumed that there would be a negligible increase in recreational use of the PAPA because wellfield workers typically do not recreate near project sites and generally leave the area when they are not working. BLM acknowledged the potential for immigrant workers to impact recreation resources by parking overnight and camping or setting up residence at recreation sites. Typically, these types of problems are generated when adequate housing is not available though it was assumed that illegal camping on public lands or at public recreation facilities would be isolated cases. The following is a list of potential impact to Recreational Resources anticipated in the PAPA DEIS:

- project development and operation would affect the visual and aesthetic quality associated with dispersed recreational experiences (e.g. hunting, fishing, mountain biking, etc.) by increasing traffic, producing noise and dust and by adding production facilities and other disturbances to the landscape which would cause a loss of open space and solitude.
- impacts would be most severe on the north end of the PAPA near Pinedale where residents use the area regularly. However, other areas within the PAPA that are used for dispersed recreation could also be impacted by project development.
- hunters may find it unsafe to use some areas because of the density of development or they may have a less rewarding experience if project activities affect wildlife populations in the area.
- people fishing or floating on the Green or New Fork rivers in the project area may be discouraged by project activities adjacent to these rivers which could impact their recreational experience.
- individuals visiting the Lander Trail in the PAPA to experience the historic setting of the area may also be affected by the industrial change in the landscape from development.

BLM defined several specific areas where future development in the PAPA would conflict with recreation use as it existed in 1999. BLM considered the following impacts associated with these conflicts significant if:

- project related activities result in long-term elimination or reduction of recreation use in any of these areas; or
- any of the alternatives result in a level of development incompatible with the stated objectives of special recreation management areas.

Based on these criteria, significant impact to dispersed recreation use was anticipated for all alternatives, except the *No Action Exploration/Development Scenario*, in the area immediately south of Pinedale (along the Pinedale South Road) if project development became extensive and use of the Pinedale South or Mesa roads by wellfield traffic increased. A significant impact was predicted to a very small portion of the Wind River Front Special Recreation Management Area (SRMA) under the *Project Wide and Anticline Crest* development scenarios in the PAPA DEIS (BLM, 1999a). Because there are no specific measures of recreation use in the PAPA, it is not possible to determine whether significant impact, based on the criteria in the PAPA DEIS, has occurred.

4.6.3 Alternative Impacts

4.6.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Impact to Recreation Resources, specifically public recreation areas that have been delineated in the PAPA, has occurred, primarily through surface disturbance associated with wellfield development. Approximately 27 acres of the Wind River Front SRMA will have been impacted by wellfield development by the end of 2006 and an additional 0.3 acre in the SRMA would be affected under the Proposed Action and Alternative C (Table 4.6-1). Potential new surface disturbance within other Public Recreation Areas in the PAPA associated with each alternative is included in Table 4.6-1.

By the end of 2006, surface disturbance by wellfield development will have disturbed an estimated 5,059 acres across the landscape, 4,225 acres within the public recreation areas in Table 4.6-1. Implementation of the alternatives would continue to change the characteristics of most of the PAPA to a landscape where "*one is constantly aware that extensive development activities are ongoing*." Though not quantified, one may assume that the development and operation of natural gas resources in the PAPA affected the visual and aesthetic quality associated with dispersed recreational experiences, one of several impacts anticipated in the PAPA DEIS (BLM, 1999a) (also see Visual Resources, Section 4.7, below). Impacts as a result of any of the alternatives may not be significant but dispersed recreational use of the PAPA would not be enhanced.

Table 4.6-1
Surface Disturbance in Relation to Public Recreation Areas by Alternative

Public Recreation Area	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Mount Airy OHV Open Use Area	195.8	304.3	197.6	197.6	702.0	546.3
Area of OHV Use Limited to Existing Roads and Trails	1,612.3	1,211.4	2,940.1	2,759.1	3,944.6	3,653.5
Desert General OHV Open Use Area	2,390.7	2,294.2	2,975.3	2,947.6	5,881.5	6,576.9
Wind River Front SRMA	26.6	0.0	0.3	0.3	0.3	0.3
Total	**4,225.4**	**3,809.9**	**6,113.3**	**5,904.6**	**10,528.4**	**10,777.0**

Pipeline Corridors and Gas Sales Pipelines

The proposed corridor/pipeline alignments would not directly affect existing dispersed recreational opportunities in the project area. Corridor designation would not affect current land uses or overall management direction by federal, state, and private land managers.

Actual disturbance or displacement of the affected area's characteristic, dispersed recreational activity may occur near pipeline construction activities; however, this impact would be limited in both extent and duration as the construction activity would migrate across the landscape and would not be concentrated at a single location for an extended period. Construction of specific pipelines would occur sequentially within a corridor, within a construction season and over a period of years. Consequently, the area of disturbance and the impact on recreational travel (use of roads) would be minor.

Depending on timing of pipeline construction activities, overall minor conflicts with hunting opportunities could result in localized interruption of activities for a given area. The conflict would be temporary, a matter of a few days, and limited to an area immediately surrounding pipeline construction. Temporary displacement of game animals caused by construction activity and noise may occur. Impacts to recreational use of the rivers would be temporary and would be limited pipeline construction across the rivers. Conflicts with recreational uses of the Green River would be temporary and would be minimized because the Green River would be crossed by HDD construction techniques.

4.6.3.2 Alternative A (No Action Alternative)

Wellfield development has affected the Desert General OHV Open Use Area south of the New Fork River (Table 4.6-1). Continued development, through 2011, under the No Action Alternative, would affect 2,294 additional acres in the Desert General OHV Open Use Area. The No Action Alternative would generate no new disturbance in the Wind River Front SRMA. Disturbance by existing wellfield development within recreation areas on the Mesa would nearly double by 2011, affecting the Mount Airy OHV Open Use Area and other areas of existing roads and trails on the Mesa. Current restrictions on recreational travel across the Mesa and Mount Airy OHV Open Use Area to protect deer and antelope on winter range would continue under the No Action Alternative, if needed. Vehicular access during winter in the recreation areas would be limited to production related traffic and traffic associated with drilling in the mostly single operated contiguous leaseholds in the northern portion of the PAPA (BLM, 2004a).

4.6.3.3 Alternative B (Proposed Action Alternative)

<u>Proposed Action Alternative Through 2011</u>

Through 2011, wellfield development under the Proposed Action Alternative is expected to affect more surface within the Desert General OHV Open Use Area than the No Action Alternative. There would be more surface disturbance under the Proposed Action Alternative than under the No Action Alternative in the Area of OHV Use Limited to Existing Roads and Trails although surface disturbance would be less in the Mount Airy OHV Open Use Area. Current restrictions on recreational travel across the Mesa and Mount Airy OHV Open Use Area during the winter to protect deer and antelope on winter ranges might continue under the Proposed Action Alternative, if needed. However, extensive vehicular traffic during winter is expected in recreation areas with year-round drilling through 2011 under the Proposed Action Alternative.

<u>Proposed Action Alternative Through 2023</u>

After 2017, there would be a steady decline in winter traffic through 2023 under the Proposed Action Alternative. Production related traffic would be reduced by installation of a liquids gathering system in the central and southern portions of the PAPA and increased use of computer assisted remote monitoring. At some point, restrictions on recreational travel across the Mesa and Mount Airy OHV Open Use Area during the winter might effectively protect deer and antelope on winter ranges, if needed.

4.6.3.4 Alternative C

<u>Alternative C Through 2011</u>

Through 2011, Alternative C is expected to affect more surface disturbance within the Desert General OHV Open Use Area and the Area of OHV Use Limited to Existing Roads and Trails than is the No Action Alternative. However, surface disturbance in the Mount Airy OHV Open Use Area is expected to be less under Alternative C through 2011 than the No Action Alternative. Disturbance by Alternative C through 2011 is expected to be comparable to those generated by the Proposed Action Alternative. Current restrictions on recreational travel across the Mesa and Mount Airy OHV Open Use Area during winter to protect deer and antelope on winter ranges might continue under Alternative C, if needed. However, extensive vehicular traffic during winter would be expected in recreation areas with year-round drilling through 2011, especially in the southern portion of DA-1 and in all of DA-2. Restrictions on winter recreational traffic, if applied, are expected to be most effective within the Mount Airy OHV Open Use Area.

<u>Alternative C Through 2023</u>

By 2023, Alternative C is likely to result in similar distribution of surface disturbance as the Proposed Action Alternative among the three public recreation areas. Table 4.6-1 shows differences in surface disturbance between the two alternatives, however, the difference is based on modeled outcomes for projection of disturbance. Therefore, it is more realistic to look at a range of disturbance between the two alternatives. In the end, surface disturbance within recreation areas would be similar under the two alternatives. After 2017, there would be a steady decline in winter traffic through 2023 under Alternative C. Production related traffic would be reduced by installation of a liquids gathering system in the central and southern portions of the PAPA and increased use of computer assisted remote monitoring. At some point, restrictions on recreational travel across the Mesa and Mount Airy OHV Open Use Area during the winter might effectively protect deer and antelope on winter ranges, if needed.

4.6.4 Cumulative Impacts

The CIAA for Recreation is the PAPA. Residents of Sublette County placed high value on recreational opportunities and people who moved there cited recreation as one reason for choosing to live there (McLeod et al., 1998). In the past, use of the PAPA included OHV-oriented recreation. OHV use within Sublette County has increased annually from 2002 through 2005 (based on numbers of OHV permits issued) though not as much as in other Wyoming counties, due in part to the relatively small population (Foulke et al., 2006b).

Before issuance of the PAPA ROD (BLM, 2000b), most of the OHV use in the PAPA was in three assigned areas; Mount Airy OHV Open Use Area, Area of OHV Use Limited to Existing Roads and Trails, and the Desert General OHV Open Use Area. Past disturbance unassociated with wellfield development in the PAPA (Table 4.6-2) occurred within each of the OHV-use areas, mainly by a variety of roads (arterials, collectors), livestock facilities and a few gravel quarries. All past disturbances to OHV-oriented recreational areas in the PAPA totaled approximately 460 acres (Table 4.6-2).

Currently, surface disturbance associated with wellfield development within the OHV-oriented recreational areas is nearly ten times the disturbance unassociated with wellfield development, amounting to 4,225 acres (Table 4.6-2). Reasonably foreseeable development in the PAPA is focused on the disturbance associated with each of the alternatives.

The cumulative impact to public recreation areas in the PAPA (Table 4.6-2) is based solely on estimates of surface disturbance within the areas by wellfield development projected by each alternative. Total cumulative impact by the Proposed Action Alternative and Alternative C exceed cumulative effects by the No Action Alternative for all public recreation areas except the Wind River Front SRMA. The difference in levels of cumulative impact among the alternatives is most apparent in the effects to Area of OHV Use Limited to Existing Roads and Trails. All alternatives would generate the most cumulative impact within the Desert General OHV Open Use Area, more by the Proposed Action Alternative and Alternative C in 2011 than by the No

Action Alternative and even more by the two alternatives in 2023 than by the No Action Alternative in 2011.

Table 4.6-2
Cumulative Surface Disturbance in Relation to Public Recreation Areas by Alternative

Public Recreation Area	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Mount Airy OHV Open Use Area	77.2	195.8	577.3	470.6	470.6	975.0	819.3
Area of OHV Use Limited to Existing Roads and Trails	151.2	1,612.3	2,984.1	4,712.8	4,531.8	5,717.3	5,426.2
Desert General OHV Open Use Area	231.3	2,390.7	5,265.3	5,946.4	5,918.7	8,852.6	9,548.0
Wind River Front SRMA	0.0	26.6	26.6	26.9	26.9	26.9	26.9
Total	**459.7**	**4,225.4**	**8,853.3**	**11,156.7**	**10,948.0**	**15,571.8**	**15,820.4**

4.6.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to recreation resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.7 VISUAL RESOURCES

4.7.1 Scoping Issues

There were no public scoping concerns related to visual resources.

4.7.2 Impacts Considered in the PAPA DEIS

The Mesa "breaks," foothills and sandstone ridges form the background west of U.S. Highway 191. The management objective of VRM Class II is to retain the existing character of the landscape, the level of change to the character of the landscape should be low, and management activities should not attract the attention of the casual observer. Management of visual resources in Class III areas allows for moderate change in the character of the landscape while Class IV areas allow for major modification of the landscape.

Visibility analysis conducted for the PAPA DEIS (BLM, 1999a) determined that a portion of the PAPA would be visible from sensitive viewpoints near Pinedale. Wellfield development, shown on Map 3.9-2 and identified as the Sensitive Viewshed SRMZ, would be noticeable as visual resource impacts because the impacted area would be seen from many points in the Town of

Pinedale, residential areas, and along U.S. Highway 191. In particular, night lighting effects within the Sensitive Viewshed SRMZ during drilling would be visible from all of the sensitive viewpoints. BLM noted that night lighting in general can impact areas far from the drilling activity and areas outside of the PAPA.

The PAPA DEIS (BLM, 1999a) considered a significant impact to visual resources on federal lands and minerals would occur if project related development did not meet BLM's VRM class objectives for an area: Significant visual impacts would occur if:

- oil and gas development becomes the dominant feature in the landscape where objectives for that land are to maintain the existing character of the landscape; or
- there is an apparent change, to the casual observer, from a natural landscape to an "industrialized appearing" landscape in areas visible from U.S. Highway 191, residential areas, and the Town of Pinedale.

Based on the significance criteria, the PAPA DEIS (BLM, 1999a) stated that significant impacts to visual resources in the PAPA could occur for all alternatives except the *No Action Exploration/ Development Scenario*. Visual resources in localized areas have been significantly impacted, according to impact significance defined in the PAPA DEIS. Some areas that are visible from U.S. Highway 191 and some residential areas have changed from a natural landscape to an "industrialized appearing" landscape since 2000. Significant impact has occurred to visual resources in these locations, according to the significance criteria in the PAPA DEIS.

4.7.3 Alternative Impacts

4.7.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Each of the alternatives is expected to disturb additional areas within VRM II by the end of 2011. The most affected VRM II land in the PAPA is along the New Fork River near Pinedale and in riparian zones in the central portion of the PAPA. As stated above, there are localized areas that have been significantly impacted and would be further impacted by each alternative through 2011 and by the Proposed Action Alternative and Alternative C through 2023 (Table 4.7-1).

Table 4.7-1
Surface Disturbance in Relation to VRMs and the Sensitive Viewshed SRMZ by Alternative

VRM Classes	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
VRM II	354.8	258.9	285.9	341.1	855.9	748.0
VRM III	1,093.8	959.0	1,075.8	1,251.7	2,182.6	1,960.3
VRM IV	3,610.8	3,266.6	5,483.3	5,263.8	9,239.9	9,563.3
Total in VRM Classes	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**
Sensitive Viewshed SRMZ	406.2	319.6	242.7	242.7	1,022.2	912.0

The Sensitive Viewshed SRMZ has similarly been affected by wellfield development in the PAPA through 2006 (Table 4.7-1). Additional disturbance by all alternatives within the SRMZ would result from construction of the 7.5-mile long, 30-inch gas pipeline from the Stewart Point Area to the 4-way area along existing rights-of-way and the 22.8-mile long, 10-inch water line from the Stewart Point area to Highway 351 (see Section 2.4.2.1).

Most disturbance, by any alternative, would be within land classified as VRM IV. However, substantial portions of the VRM III class would be affected by all alternatives, primarily within the northern end of the PAPA and along the New Fork River. Some development in VRM Class III lands on the west side of U.S. Highway 191 has occurred in the southern end of the PAPA and additional development is expected under all alternatives. Wellfield development could disturb about 2,000 acres in VRM Class III by the Proposed Action Alternative and Alternative C by 2023 (Table 4.7-1). This level of development would exceed BLM's management objective for the VRM III class, which allows for only moderate change in the character of the landscape. Visual resources in the localized areas of VRM II and VRM III have been significantly impacted (according to impact significance defined in the PAPA DEIS) and would be further impacted under all alternatives. Depending on the success of future revegetation efforts, the PAPA may not appear as an industrialized landscape such as it is in 2006 and effects to VRM II and VRM III lands, particularly within DA-2, may be substantially diminished. According to the significance criteria in the PAPA DEIS, impact to visual resources would continue by implementation of any of the alternatives.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Establishment of the proposed pipeline corridors would result in new pipeline construction in lands classified as VRM classes II, III, and IV. Pipeline construction would involve the removal of vegetative cover and blading, excavation, backfilling, and re-spreading of soil materials which would likely create visual contrasts with the surrounding landscape. With selective placement of surface ancillary facilities and successful reclamation and reestablishment of protective vegetative cover, pipeline construction would be consistent with the BLM's VRM objectives.

The proposed corridor/pipeline alignments would cross approximately 11 miles of VRM Class II lands at the New Fork River and Green River. The objectives of VRM Class II criteria would be maintained at all three river crossings because they would be crossed by HDD. Reclamation of the disturbed construction rights-of-way for each pipeline would allow for overall retention of the landscape's existing character. Within a short period of time (3 years), apparent changes in landscape character within the construction rights-of-way should not be readily noticeable to a casual observer.

Approximately 13 miles of the proposed corridor/pipeline alignments would cross areas designated as VRM Class III. These areas are on either side of the river crossings bordering and extending beyond the VRM Class II areas. The existing character of these lands would be retained following reclamation of the affected rights-of-way. Pipeline construction and operation in VRM Class III lands would be consistent with the class objectives to partially retain the existing character of the landscape. The remaining 126 miles of proposed corridor/pipeline alignments would cross VRM Class IV landscapes that allow for major modifications of the existing character. Consistent application of reclamation procedures would meet and exceed these objectives.

4.7.3.2 Alternative A (No Action Alternative)

Continuation of wellfield development under the No Action Alternative would affect more than 3,200 acres in VRM Class IV (Table 4.7-1). The No Action Alternative is expected to affect more than 250 additional acres in VRM Class II and 960 additional acres in VRM Class III. The

No Action Alternative is likely to increase the disturbance within the Sensitive Viewshed SRMZ more than effects by the other two alternatives by 2011 (Table 4.7-1). This is because the No Action Alternative does not allow for any concentrated development as do the other alternatives.

4.7.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

Implementation of the Proposed Action Alternative would result in slightly more levels of disturbance than the No Action Alternative but less than Alternative C to VRM II and VRM III lands (Table 4.7-1) by 2011. The Proposed Action would likely affect less of the Sensitive Viewshed SRMZ than the No Action Alternative by 2011.

Proposed Action Alternative Through 2023

Under the Proposed Action Alternative, disturbance in VRM Class II lands would be about 800 acres which would be more than double the disturbance in 2006. About 1,000 acres of the Sensitive Viewshed SRMZ would be disturbed under the Proposed Action Alternative through 2023.

4.7.3.4 Alternative C

Alternative C Through 2011

Implementation of Alternative C would result in more disturbance than either the No Action Alternative or the Proposed Action Alternative to VRM II and VRM III lands (Table 4.7-1) by 2011. Effects to the Sensitive Viewshed SRMZ by Alternative C would be less than effects by the No Action Alternative by 2011.

Unlike the Proposed Action Alternative, there would be no new disturbance within the northern portion of DA-1 and within DA-3 until development is complete in the southern portion of DA-1 and in DA-2. VRM classes II and III would be more affected by Alternative C through 2011 than they would be the Proposed Action Alternative through 2011.

Alternative C Through 2023

By 2023, effects to VRM classes II and III would be similar to that under the Proposed Action Alternative through 2023. Effects to the Sensitive Viewshed SRMZ under Alternative C through 2023 would be similar to the Proposed Action Alternative through 2023.

There is more opportunity for focal points of final reclamation under Alternative C than under the Proposed Action Alternative as development moves north from the southern portion of DA-1 and as development moves from DA-2 to DA-3.

4.7.4 Cumulative Impacts

Residents of Sublette County placed high value on the surrounding scenery and people who moved there cited scenery associated with the Wind River Range to the east and the Wyoming Range to the west as one reason for choosing to live there (McLeod et al., 1998). Reflecting on and reinforcing the scenic values held by residents of Sublette County, BLM established management objectives in portions of the PAPA that would retain the visual characteristics of some landscapes.

Prior to natural gas development that followed the PAPA ROD in July 2000, most surface disturbance within VRM II and VRM III lands in the PAPA had been by agriculture with some disturbance by roads and residences. This disturbance contributes to the existing non-wellfield surface disturbance listed in Table 4.7-2. Most, if not all, of this disturbance was present when BLM classified the VRM II and VRM III lands in the Pinedale RMP (BLM, 1988b). Similar existing non-wellfield disturbance occurred within the Sensitive Viewshed SRMZ that was identified for the area's visual qualities in the PAPA DEIS (BLM, 1999a).

The cumulative impact to VRM Classes in the PAPA (Table 4.7-2) is based on estimates of surface disturbance by wellfield development projected into the future (2011 and 2023) by each alternative. Total cumulative impact by the Proposed Action Alternative and Alternative C exceeds cumulative effects by the No Action Alternative for all VRM classes although effects to VRM II lands in 2011 would be nearly the same for all alternatives. Likewise, cumulative surface disturbance within the Sensitive Viewshed SRMZ in 2011 is roughly equivalent among alternatives. The difference in level of cumulative impact among the alternatives is most apparent in the effects to VRM IV lands. There is more effect within all VRM classes and the Sensitive Viewshed SRMZ by the Proposed Action Alternative and Alternative C in 2011 than by the No Action Alternative, and certainly more under these two alternatives by 2023.

Table 4.7-2
Cumulative Surface Disturbance in Relation to VRMs and the Sensitive Viewshed SRMZ by Alternative

VRM Classes	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
VRM II	3,976.5	354.8	4,617.9	4,644.9	4,700.1	5,214.9	5,107.0
VRM III	3,173.7	1,093.8	5,289.8	5,406.6	5,582.5	6,513.4	6,291.1
VRM IV	316.7	3,610.8	7,529.4	9,746.1	9,526.6	13,502.7	13,826.1
Total in VRM Classes	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**
Sensitive Viewshed SRMZ	4,786.8	406.2	5,512.6	5,435.7	5,435.7	6,215.2	6,105.0

4.7.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to visual resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.8 CULTURAL AND HISTORIC RESOURCES

4.8.1 Scoping Issues

There were no project scoping comments related to cultural and historic resources.

4.8.2 Impacts Considered in the PAPA DEIS

Because of the requirement for compliance with Section 106 of the National Historic Preservation Act (NHPA) and with the Archeological Resources Protection Act (ARPA), all areas on federal lands and minerals proposed for surface disturbance would be surveyed for cultural resources. Procedures for identifying and protecting cultural resources on private or State of Wyoming lands are not in place. Only if a project involves a federal permit or authorization (e.g., a pipeline crossing on both BLM and private land), would federal historic preservation requirements apply. On federal lands, any undertaking by Operators would follow the BLM National Programmatic Agreement Process, as identified in BLM's State Protocol Agreement between BLM and the Wyoming SHPO (Appendix G), prior to any surface disturbing activity and would either avoid or protect cultural resource properties and sacred sites.

As stated in the PAPA DEIS (BLM, 1999a), the preferred strategy for treating potential adverse effects on cultural properties is "avoidance." That strategy has been used in some circumstances during wellfield development through 2006 (see Section 3.8). If avoidance was imprudent or unfeasible, appropriate mitigation has included excavation (data recovery), stabilization, monitoring, protection barriers and signs, Native American consultation, archival or ethnographic studies, or other physical and administrative measures. Traditional tribal elders have been consulted regarding the importance of specific features identified, and for their recommendations on appropriate avoidance distances. Distances were established through consultation with the Shoshone Tribe and tribal guidelines for buffer zones for development near Native American sites as described in Chapter 3 (Section 3.8).

The PAPA DEIS (BLM, 1999a) recognized that a significant impact to cultural or historical resources, as defined by 36 CFR 800.5 (July, 1999 version) would include:

- An undertaking that alters, directly or indirectly, characteristics of a historic property that qualify the property for inclusion in the National Register (of Historic Places) in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register.
- Adverse effects on historic properties include, but are not limited to: (i) physical destruction of or damage to all or part of the property; (ii) alteration of a property, including restoration, rehabilitation, repair, maintenance, and stabilization; (iii) removal of the property from its historic location; (iv) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; and (v) introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.

Significant impacts based on one or more of the criteria above has occurred. Complete documentation of all occurrences of significant impacts is not available.

4.8.3 Alternative Impacts

4.8.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Additional disturbance within the 0.25-mile Lander Trail buffer, Lander Trail SRMZ, and Lander Trail viewshed are expected by each Alternative in 2011 (Table 4.8-1). With full development through 2023, the Proposed Action Alternative and Alternative C are expected to disturb substantial areas within the Lander Trail SRMZ (Table 4.8-2). Disturbance would probably change of the character of the Lander Trail's use and of physical features within the Trail's setting that contribute to its historic significance, a significant impact according to criteria defined by 36 CFR 800.5, above.

Table 4.8-1
Surface Disturbance in Relation to the Lander Trail SMRZ and 0.25-Mile Buffer by Alternative

Lander Trail SRMZ Category	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Lander Trail 0.25-mile Buffer	67.3	23.0	67.8	74.5	122.1	212.1
Lander Trail SRMZ (PAPA DEIS)	532.8	520.5	800.7	702.5	1,588.8	1,670.5
Lander Trail Viewshed (PAPA ROD)	388.1	332.4	444.6	520.0	1,138.5	1,304.4

Impact to cultural resources would most likely be direct, resulting from any of the adverse effects stated above. Indirect impacts are likely if historic properties and other cultural resources are adversely affected because of increased human access and subsequent vandalism.

Pipeline Corridors and Gas Sales Pipelines

Specific Class III cultural resource inventories have not been completed in the proposed pipeline corridors. Information compiled from inventories completed adjacent to proposed corridors indicate that impacts to cultural and historical resources would likely result from pipeline construction. An estimated 35 cultural resource sites recommended as eligible for nomination to the NRHP could be affected by construction of the two pipelines in the BCC and the single pipelines in BFGC and OPC. An estimated 11 crossings of eligible historic trails/roads would result from construction of the proposed R6, PBC, and Opal Loop III pipelines.

The impacts anticipated at each of the historic trail crossings are discussed by trail below. The setting for all trail segments at the proposed pipeline crossings are compromised by past and/or ongoing disturbances.

Lander Cutoff. The proposed BCC and proposed R6 and PBC pipeline alignments cross the Lander Cutoff in Section 29, T. 31 N., R. 108 W on BLM administered lands. The proposed and R6 (staked) and PBC pipelines would be located on the west side of the existing pipeline corridor at the trail crossing. The area where the historic trail would be crossed by the proposed pipelines would be fenced to prohibit construction damages to the trail ruts. For each pipeline, the fences would extend a minimum of 50 feet each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the position of the fence. A bore under the historic trail from outside the fenced areas would eliminate new impacts to the historic ruts; however, the crossing method for this trail would be decided at a later date in consultation with the PFO archaeologist.

Oregon Trail. The proposed BCC and R6 Pipeline would cross the Oregon Trail in two locations. The southernmost crossing of the Oregon Trail occurs in Section 28, T. 19 N., R. 111 W. on land owned by Anadarko Land Corporation. The area has been disturbed. The proposed R6 Pipeline is staked on the west side of the existing pipeline corridor at the historic trail crossing. The trail would be crossed by HDD and the HDD would include the crossings of the

Union Pacific Mainline Railroad, Highway 375, and the Blacks Fork River. The proposed HDD would be 1,000 feet in length. The second crossing of the Oregon Trail/Pony Express Route occurs in Section 33, T. 20 N., R. 111 W., on land owned by Uinta Development. The area has been disturbed. The proposed pipeline is staked on the east side of the existing pipeline corridor at the historic trail crossing. The pipeline would be installed using conventional ditching methods and would parallel the east edge of the existing pipeline rights-of-way. No fencing is proposed at either of the trail crossing sites. Construction would be contained within previous disturbance.

The East Bank Kinney Cutoff. The proposed BCC and R6 Pipeline would cross the East Bank Kinney Cutoff in Section 9, T. 23 N., R. 111 W., on land administered by BOR. The proposed R6 Pipeline is staked on the east side of the existing pipeline corridor at the crossing of the trail. The area where the historic trail is crossed would be fenced to prohibit construction damages to the trail ruts. The fences would extend a minimum of 50 feet on each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the location of the fencing. The trail crossing would be bored from outside the fenced areas, eliminating new impacts to the historic ruts.

The proposed OPC and Opal Loop III Pipeline would cross the East Bank Kinney Cutoff. The proposed pipeline is yet not staked, and therefore, specific methods of pipeline crossing have not been determined. However, approved discovery plans would be followed to minimize or avoid impacts to the historic trail.

The Baker Davis Road/Slate Creek Cutoff. The proposed BBC and R6 Pipeline would cross the Baker Davis Road/Slate Creek Cutoff in Section 34, T. 24 N., R. 111 W., on land administered by the BOR. The proposed R6 Pipeline is staked on the east side of the existing pipeline corridor at the trail crossing. The area where the historic trail would be crossed would be fenced to prohibit construction damage to the trail ruts. The fences would extend a minimum of 50 feet on each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the position of the fence. A bore under the historic trail from outside the fenced areas would eliminate new impacts to the historic ruts.

The proposed OPC and Opal Loop III Pipeline would cross the Baker Davis Road/Slate Creek Cutoff. The proposed pipeline is not yet staked and specific methods of pipeline crossing have not been determined. However, approved discovery plans would be followed to minimize or avoid impacts to the historic trail.

Sublette Cutoff. The proposed pipeline would cross the Sublette Cutoff in Section 9, T. 26 N., R. 111 W., on land administered by the BLM. The proposed R6 Pipeline is staked on the east side of the existing pipeline corridor at the trail crossing, east of the County Line Road. The area where the historic trail is crossed by the proposed pipeline would be fenced to prohibit construction damages to the trail ruts. The fences would extend a minimum of 50 feet on each side of the trail center point for a total of 100 feet. A permitted archaeologist would determine the position of the fence. A bore under the historic trail from outside the fenced areas would eliminate new impacts to the historic ruts.

4.8.3.2 Alternative A (No Action Alternative)

Wellfield development within the PAPA under the No Action Alternative would generate an estimated 4,485 acres of additional surface disturbance, which includes new well pads, pipelines and roads. Because surface disturbing activities are directly associated with impacts to cultural resources, it is likely that these resources, especially archaeological artifacts, would continue to be impacted in much the same way and at similar rates as they have since the issuance of the PAPA ROD. Currently, and as continued under the No Action Alternative, winter drilling is isolated to a few locations. The absence of winter drilling would continue to allow resource managers to effectively mitigate unexpected discoveries during construction.

Major finds in areas such as those at the sandy bluffs on the north side of the New Fork River and on the north and south ends of the anticline would continue to be impacted under the No Action Alternative. Wellfield disturbance in quarter-sections in these areas are projected to increase by between 10 to 40 percent, which would invariably result in more discoveries. Additionally, the potential for nearly 47 miles of new roads under the No Action Alternative raises potential for more finds and unexpected discoveries.

The No Action Alternative would have the least impact of all alternatives to the Lander Trail 0.25-mile buffer and SRMZ (Table 4.8-1). Potentially 23 additional acres would be disturbed within the 0.25-mile buffer zone, approximately 520 acres would be disturbed within the 22,893-acre Lander Trail SRMZ and 332 acres would be disturbed within the trail viewshed under the No Action Alternative. This alternative continues a trend of minimal new surface disturbance along the Lander Trail although it would continue to alter the Trail's historically significant setting through 2011.

Further, the Sensitive Viewshed and Mesa Breaks management areas (MA 4 and MA 2, respectively) near Stewart Point in the northern portion of the PAPA would remain protected under the No Action Alternative. This region of the PAPA has been documented as having potential for archaeological discoveries (see discussion in Chapter 3). Although winter drilling would continue near these areas, there would be no additional well pads allowed under BLM's 2004 Decision Record (BLM, 2004a), and further surface disturbance would be limited to expansion of existing well pads.

4.8.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

The Proposed Action Alternative through 2011 could result in a much higher probability of resource destruction and unexpected discoveries than the No Action Alternative. An estimate of more than 6,845 additional acres of surface disturbance by 2011 could place significant strain on the cultural and historical resources in the PAPA. The potential exists for 2,200 more acres of surface disturbance under the Proposed Action Alternative than for the No Action Alternative through 2011. Most of this would be in the form of 179 new and expanded well pads and new access roads. Some pads could be expanded by up to 30 acres and this is a concern for cultural resource managers. Unexpected discoveries and subsequent resource damage could significantly increase in areas of large, concentrated surface disturbances (Vlcek, 2006).

Development under the Proposed Action Alternative could cause an estimated 68 additional acres of surface disturbance in the Lander Trail 0.25-mile buffer, about twice what currently exists. Approximately 800 additional acres of disturbance is expected within the Lander Trail SRMZ (Table 4.8-1), which is nearly 280 acres more than under the No Action Alternative. There would be less disturbance to the Lander Trail viewshed (445 acres) through 2011 than would be expected under Alternative C, mainly due to focused development just north of State Highway 351 by that alternative.

In addition to surface disturbance issues, year-round drilling poses the potential for significant impacts to the resource. Mitigation, most commonly done through salvage excavations, cannot take place during the winter months when the ground is frozen and often snow-covered. Under law, construction activities could be halted because of resource discoveries in the winter months, if mitigation techniques cannot take place during those times. Not only does this threaten to adversely impact the resource by prolonged exposure to extreme weather and potential vandalism or theft, it may cause significant additional expense to the Operator (Vlcek, 2006).

While the surface disturbance elements of the Proposed Action Alternative through 2011 would threaten cultural resources, aspects of that alternative could result in resource protection. For example, two areas located in Section 11, T. 31 N., R. 109 W. are adjacent to major find sites on the sandy bluffs just north of the New Fork River. The Proposed Action Alternative would possibly generate less surface disturbance proximate to those sites due to confined year-round development within the core area and CDA-2 that would not include those archaeologically significant areas.

Proposed Action Alternative Through 2023

Full development through 2023 under the Proposed Action Alternative is expected to bring substantial surface disturbance within the Lander Trail SRMZ and trail viewshed. This alternative could disturb nearly 1,600 acres with the SRMZ and more than 120 acres within the Trail's 0.25-mile buffer. Potential surface disturbance by this alternative in the Lander Trail SRMZ is enumerated in Table 4.8-1. This level of development could adversely impact the Trail's setting and historical significance.

Increased probability of unexpected discoveries and the potential resource damage that accompanies them continues in this phase of the Proposed Action Alternative. With more than 10,700 total acres likely to be disturbed 2023, it is anticipated that resource discovery and damage trends would continue, although exact figures are impossible to determine.

Further, with extensive surface disturbance (disturbance in many quarter section exceeding 50 percent) throughout the PAPA, it is likely that more major finds would be discovered under the Proposed Action Alternative through 2023. Currently, there are nearly 4,000 acres of wellfield surface disturbance on federal lands and minerals within the PAPA, with about three major finds. By 2023, surface disturbance on federal lands within the PAPA could result in not only several more discoveries in areas of existing development, but also discoveries in areas not known for significant archaeological resources.

Potentially, large numbers of unexpected discoveries could slow the pace of development through increased mitigation. Currently, most mitigation occurs as excavations supervised by permitted archeologists. If several excavations are necessary within a given quarter-section, operators may be forced to postpone construction and drilling activities.

Well drilling would continue during the winter months, although it would be on fewer well pads each year through 2023. As with the Proposed Alternative through 2011, year-round drilling can cause significant adverse impacts. Mitigation in the form of excavations is often impossible during the winter months when the ground is frozen and snow-covered. If extensive need for winter mitigation arises, alternative methods of resource protection could need to be researched and implemented.

4.8.3.4 Alternative C

Alternative C Through 2011

Alternative C is likely to result in about 100 acres less surface disturbance to the Lander Trail SRMZ than the Proposed Action Alternative by 2011. Within the Trail's 0.25-mile buffer, only about 7 fewer acres would be disturbed than by the Proposed Action through 2011 (Table 4.8-1).

Development under Alternative C through 2011 is projected to concentrate surface disturbance in portions of the PAPA differently than the Proposed Action. Focal areas of disturbance would be in the southern part of DA-1, all of DA-2, and throughout DA-4, the larger expanse of development within the core area under the Proposed Action. For cultural resources, this means significant surface disturbance would continue in much the same way north of the New Fork River within the PAPA, but potentially would be more limited directly south of the New Fork River in DA-3 than by the Proposed Action Alternative. Potential areas of major finds along the sandy bluffs north of the New Fork River would likely be impacted more with the levels of concentrated development in DA-2 through 2011. Development within DA-4 north of State Highway 351 would generate more surface disturbance within the Lander Trail viewshed by 2011 than would the Proposed Action Alternative.

Alternative C Through 2023

With full development through 2023, Alternative C is expected to generate about the same amount of surface disturbance throughout the PAPA as the Proposed Action Alternative (Table 4.8-1). Full development under Alternative C could result in more than 200 acres of additional surface disturbance in the Lander Trail 0.25-mile buffer. This is considerably higher than the estimated 67 acres currently disturbed there. The potential surface disturbance would probably significantly alter the setting and use of the Lander Trail within the PAPA.

4.8.4 Cumulative Impacts

The cumulative impact analysis area for cultural and historic resources in the PAPA DEIS (BLM, 1999a) was an approximate 330,740-acre area which included the PAPA and a surrounding 2-mile buffer. The buffer was based on the assumption that roads could be constructed anywhere within the PAPA, and 2 miles past its boundaries would provide a reasonable limit to the distance thieves and vandals could wonder from roads in search of cultural or historic artifacts. Because development in the PAPA since 2000 has provided resource managers with more insight on cultural resources within the region, and the natural gas development patterns are more predictable, the CIAA in this section is confined to the PAPA. As of 2006, the majority of development and subsequent surface disturbance and roads have occurred along the Anticline Crest region. It is projected under all alternatives that this would continue to be the case through full field development.

In the PAPA, surface disturbance is the major factor determining adverse impacts for cultural and historic resources. Estimated cumulative surface disturbance within the Lander Trail SMRZ and trail viewshed is summarized in Table 4.8-2. It is projected that cumulative impacts to the Lander Trail would result in significant degradation to its setting and use under both the Proposed Action Alternative and Alternative C. Further, under all project development alternatives, cumulative impacts would increase with increased surface disturbance and human activity, and significant cumulative effects to cultural resources could occur if undocumented and unrecognized NRHP-eligible sites are impacted and unmitigated. Because of the unpredictable nature of archaeological discoveries made during construction in the PAPA, adverse effects could occur on sites not identified by customary inventory and evaluation work.

However, inventory, recording, and data recovery projects triggered by surface disturbance would continue to increase the cultural resource database, likely improving future cultural resource management decisions. In the last few years, several major new archeological discoveries have been documented, greatly increasing knowledge of the prehistoric period of the PAPA and Upper Green River Basin. Generally, the greater the increase in permitted activity, the greater the data acquisition of cultural resource information will be.

Table 4.8-2
Cumulative Surface Disturbance in Relation to the Lander Trail SMRZ and 0.25-Mile Buffer Alternative

Lander Trail SRMZ Category	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Lander Trail 0.25-mile Buffer	6.6	67.3	665.1	709.9	716.6	764.2	854.2
Lander Trail SRMZ (PAPA DEIS)	93.7	532.8	692.3	972.5	874.3	1,760.6	1,842.3
Lander Trail Viewshed (PAPA ROD)	77.5	388.1	798.0	910.2	985.6	1,604.1	1,770.0

4.8.5 Alternative Impact Mitigation

Mitigation for impacts to Cultural Resources is discussed in Chapter 3 (Section 3.10.1.5) and in Chapter 4 (Section 4.7.3). A segment of the Lander Trail is currently managed under a PA between BLM, the Wyoming SHPO, the Advisory Council on Historic Preservation, Shell, and Ultra to maintain the integrity of the trail (see Appendix H). The PA does not include other Operators developing near the Lander Trail. They would be responsible for creating their own individual mitigation or management plans. In addition to the PA, the Wyoming Protocol Agreement (see Appendix G), is a document that describes the consultation process between the Wyoming SHPO and BLM regarding cultural resource management (though not specific to the PAPA). Both documents describe how archeological resource management would be implemented under any of the alternatives.

The proposed corridor/pipeline alignments cross historic trails at points considered as contributing to their eligibility nomination for the NRHP. All surface disturbing activity within 200 feet of the East Bank Kinney Cutoff, the Baker Davis Road/Slate Creek Cutoff, the Sublette Cutoff, and the Lander Cutoff would be monitored by an archaeologist who meets or exceeds the qualification standards recommended by the Secretary of the Interior. With the application of mitigation measures described above and those to be developed and documented in discovery plans following completion of Class III inventories of the proposed corridor/pipeline alignments, there should be no significant impacts to any historic properties.

4.9 AIR QUALITY

4.9.1 Scoping Issues

Air quality related concerns have increased in the Upper Green River Basin, including Pinedale, as natural gas development continues in the PAPA and in the Jonah Field. Because of this awareness, a number of comments were received during scoping. They are summarized below:

1. There should be a detailed air quality analysis including a cumulative analysis for southwestern Wyoming.
2. Utilize most recent modeled and monitored ozone concentrations in the Pinedale area to address regional haze and to determine compliance with National Ambient Air Quality Standards.
3. Model and disclose impacts to PSD Class I and sensitive PSD Class II areas by winter drilling, completions, and flaring in the PAPA and in the cumulative impact analysis area.

4. Compare emissions estimated from the original PAPA EIS to those from the proposed action.
5. Address cumulative impacts to high mountain lakes and downstream impact to trout and water users.
6. Provide evaluations of how effective the ASU Year-Round Drilling Demonstration Project emission mitigation has been and effectiveness of the Naughton Power Plant Unit 3 retrofit on regional air quality.
7. Concern regarding emissions from flaring operations.
8. Discuss use of low emission drilling rigs, best available technology, and other mitigation measures to comply with Wyoming Department of Environmental Quality regulations.
9. Address trade-offs between directional drilling and increased air quality impact.
10. Increase air quality monitoring.

4.9.2 Impacts Considered in the PAPA DEIS

An Air Quality Assessment Protocol was developed for the PAPA DEIS (BLM, 1999a). The Protocol specified the methodologies for quantifying potential air quality impacts from the project and surrounding development. The protocol was prepared with input and review from the BLM, State of Wyoming, USFS, EPA Region VIII, NPS and the operators, thereby ensuring that the assessment methodology would be acceptable to the federal land managers. The criteria for evaluating the significance of the potential air quality impacts were also addressed. The PAPA DEIS stated significant impacts to air quality would result from project related activities if:

- PSD increments for Class I and Class II areas have been exceeded;
- National Ambient Air Quality Standards (NAAQS) or Wyoming Ambient Air Quality Standards (WAAQS) have been exceeded;
- increased toxin concentrations are above designated thresholds;
- lifetime incremental increase in cancer risk of one additional person in 1 million from the most likely exposure scenario is exceeded;
- visibility impacts to sensitive areas are above the designated 0.5 and 1.0 dv (deciview) change thresholds; or
- change in sensitive lake acid neutralizing capacity (ANC) is above the designated 10 percent level of acceptable change (LAC).

4.9.3 Alternative Impacts

4.9.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Direct, indirect, and cumulative air quality impacts were analyzed to predict maximum potential near-field (surrounding the PAPA) and far-field (PSD Class I and sensitive PSD Class II areas) ambient air pollutant concentrations, as well as maximum impacts to visibility (regional haze), and atmospheric deposition (acid rain) impacts. Analyses were also performed to predict maximum in-field (within the PAPA) pollutant concentrations and maximum mid-field (regional communities of Boulder, Cora, and Pinedale) visibility impacts.

Air quality impacts from the project would occur from pollutants emitted during construction (due to potential surface disturbance by earthmoving equipment, vehicle traffic fugitive dust, well completion and testing, and drilling rig and vehicle engine exhaust) and production (production equipment, compressor engine exhausts, vehicle traffic engine exhausts, and fugitive dust).

Pollutants emitted from these activities include NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$, VOCs, and HAPs.

Ozone may develop from NO_x and VOC emissions. The EPA screening methodology (Scheffe, 1998) for ozone analysis was planned for inclusion in this Draft SEIS. However, BLM, with the agreement of the Air Quality Stakeholder Group, has determined that the CALGRID model for ozone impact analysis is the most appropriate method for estimating ozone impact from the PAPA. Results from the CALGRID modeling analysis will be released as a supplement to the Air Quality TSD for this Draft SEIS.

In the PAPA, greenhouse gases are emitted from three main sources: internal combustion engines, combustion of fuel or waste gases, and vented gases. Carbon dioxide is the main emission from internal combustion engines (diesel, gasoline, natural gas), the combustion of fuel gas in various production process burners/heaters, and the combustion of waste gases for safety or WDEQ-AQD requirements. Currently, WDEQ-AQD does not have specific rules regulating greenhouse gas emissions, and although greenhouse gas emissions are a concern they were not analyzed in this Draft SEIS.

This air quality impact assessment is based on the operations and engineering data and assumptions available at the time of the analysis, the best available meteorology data, and currently accepted dispersion modeling procedures, as well as professional and scientific judgment. Assumptions representing most likely operating conditions were incorporated into the analysis whenever possible. For example, compression in the field was assumed to operate at 90 percent of fully permitted capacity, and drilling rig engines were assumed to operate at an average of 42 percent of maximum capacity. In cases where operating projections were not provided by the Operators, parameters were assumed to occur at maximum proposed levels. For example, impact assessments assume that all proposed wells would be productive (no dry holes).

Regulatory Authority. Air pollution impacts are limited by state and federal regulations, standards, and implementation plans established under the Clean Air Act and administered by the applicable air quality regulatory agency (WDEQ/AQD and EPA). The states of Utah, Colorado, and Idaho have similar jurisdiction over potential air pollutant emissions sources in those states, which can have a cumulative impact when combined with WDEQ/AQD regulated sources. The applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices prior to construction and/or operation. The U.S. Congress (through the Clean Air Act Section 116) also authorizes local, state, and tribal air quality regulatory agencies to establish air pollution control requirements of equal or greater stringency than federal requirements. Proposed emission sources are required to undergo a permit review by applicable air quality regulatory agencies (including state, tribal, and/or EPA) before construction can begin. The agencies review the proposed air pollutant emission sources and, depending upon the magnitude of emissions and other factors, the air quality regulatory agencies may require additional site-specific air quality analysis and/or additional emission control measures. The measures may include a Best Available Control Technology (BACT) analysis and determination to ensure protection of air quality.

Although WDEQ has the regulatory authority for air quality in Wyoming, BLM also has responsibility in regard to air quality. For example, under the Federal Land Policy Management Act (FLPMA) and the Clean Air Act, BLM cannot authorize activities that do not conform to all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans. An extensive air quality impact assessment technical support document was prepared to analyze potential impacts from the development alternatives, as well as other reasonably foreseeable emission sources. Additional detail regarding this air quality evaluation is provided in the Air Quality TSD.

The significance criteria for potential air quality impacts include state and federally enforced legal requirements to ensure that air pollutant concentrations remain within specific allowable levels. Legal requirements include the NAAQS and WAAQS, which set maximum limits for several air pollutants, and PSD increments, which limit the incremental increase of certain air pollutants (including NO_2, PM_{10}, and SO_2) above legally defined baseline concentration levels. These standards and increments are presented in Table 3.11-1.

Where legal limits have not been established, the BLM uses best available scientific information to identify thresholds of significant adverse impacts. Thresholds or levels of concern are identified for hazardous air pollutant (HAP) exposure, incremental cancer risks, a "just noticeable change" in potential visibility impacts, and potential atmospheric deposition impacts. These thresholds or levels of concern are described later in this chapter.

Impact Analysis. The assessment of direct project impacts includes near-field analyses and far-field analyses which were completed separately for the No Action Alternative (Alternative A), Proposed Action Alternative (Alternative B), and Alternative C. Alternative C is similar to the Proposed Action Alternative; however, it includes mitigation options to reduce air quality impacts. All near-field analyses used the AERMOD model; the far-field analyses used the CALPUFF model. In-field modeling (within the PAPA) and mid-field modeling (regional community locations) were part of the far-field analyses. Detailed information regarding the modeling methodologies used in the near-field and far-field analyses is provided in the Air Quality TSD.

When reviewing predicted near-field impacts, it is important to understand that results reported reflect the maximum pollutant emission rates calculated for the field. The resulting concentrations are combined with monitored background ambient pollutant concentrations. Maximum monitored background air pollutant concentrations were assumed to occur throughout the LOP at all locations in the region year-round. In addition, the maximum predicted air quality impacts from project emission sources would occur near the PAPA. Because impacts typically lessen with distance from an emissions source, impacts at locations more distant from the PAPA would be less than the predicted maximum concentrations. Finally, total air pollutant concentrations for comparison to WAAQS and NAAQS were assumed to be the sum of the maximum modeled concentration and the maximum background concentration. This methodology is used for both long-term and short-term averaging periods. For short-term averaging periods, the maximum concentrations may occur under very different meteorological conditions and may not occur simultaneously.

<u>Near-Field Analysis</u>. The near-field analysis includes impact assessments for comparison to applicable ambient air quality standards and for comparison to PSD increments. It also includes assessments of HAP impacts for comparison to applicable health-based levels for non-cancer compounds and cancer risks for carcinogens. The EPA guideline dispersion model, AERMOD was used to assess near-field impacts of NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ and to estimate short-term and long-term HAP impacts. AERMOD was applied using 1 year of meteorological data that was collected during 1999 and 2000 in the Jonah Field.

Ambient Air Quality Standards. Impacts were assessed from the phases of well pad construction or field production that produce the highest emissions. Near-field analyses for NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ focused on localized impacts from construction, drilling and field compression. Maximum predicted concentrations of all criteria pollutants were added to the ambient background pollutant concentrations for comparison to WAAQS and NAAQS and are provided in Section 4.9.3.2 and in Appendix M. Results in Appendix M are also presented as the maximum impacts expressed as a percentage of the NAAQS and WAAQS.

Comparison to PSD Increments. The near-field analyses include impact assessments for comparison to PSD increments. Ambient background concentrations were not added to modeled concentrations for comparison to PSD Class II increments. These comparisons are shown in Section 4.9.3.2 and in Appendix M.

HAP Analysis. The near-field analysis also includes assessments of HAP impacts for comparison to applicable health-based levels for non-cancer compounds and cancer risks for carcinogens. The near-field analysis assesses direct impacts in the immediate vicinity of project activities resulting from a single phase and multiple phases of construction or production reflective of maximum emissions. Maximum acute (short-term), long-term (chronic) health-based, and long-term (chronic) cancer risk impacts were modeled. The model used project alternative field-wide HAP emissions and nearest residence locations within and near the PAPA. Modeled HAP impacts representative of all project alternatives is provided in Section 4.9.3.2 and in Appendix M.

Potential maximum acute (short-term; 1-hour) HAP concentrations were compared with the acute Reference Exposure Levels (RELs) (EPA, 2006a). RELs are defined as concentrations at or below which no adverse health effects are expected. RELs are not available for ethylbenzene and n-hexane; instead, the available Immediately Dangerous to Life or Health divided by 10 (IDLH/10) values were used. The IDLH values are determined by the National Institute for Occupational Safety and Health (NIOSH) and were obtained from EPA's Air Toxics Database (EPA, 2006a).

Potential long-term (annual) HAP concentrations were compared to non-carcinogenic Reference Concentrations for Chronic Inhalation (RfCs) (EPA, 2006a). An RfC is defined by EPA as the daily inhalation concentration at which no long-term adverse health effects are expected.

Long-term exposures to emissions of suspected carcinogens (benzene and formaldehyde), were evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime. This analysis presents the potential incremental risk from these pollutants and does not represent a total risk analysis. The cancer risks were calculated using the maximum predicted annual concentrations and EPA's chronic inhalation unit risk factors (URF) for carcinogenic constituents (EPA, 2006a). Estimated cancer risks were evaluated based on the Superfund National Oil and Hazardous Substances Pollution Contingency Plan (EPA, 1990b), where a cancer risk range of 1 to 100 x 10^{-6} is generally acceptable. Two estimates of cancer risk were made; one that corresponds to a most-likely-exposure (MLE) over a national residency average of 9 years with some time spent away from home, and one reflective of the maximally-exposed-individual (MEI) residing at one location for a lifetime with no time spent away from home. The MEI estimate is adjusted for the expected 60 year LOP. For each constituent, the cancer risk is computed by multiplying the maximum predicted annual concentration by the URF and by the overall exposure adjustment factor. The cancer risks for both constituents are then summed to provide an estimate of the total inhalation cancer risk.

<u>Far Field Analysis</u>. The far-field analysis utilized the EPA CALMET/CALPUFF modeling system to predict maximum potential air quality impacts at mandatory federal PSD Class I and other sensitive PSD Class II areas, as well as designated acid-sensitive lakes. This analysis includes assessments of ambient air quality standards, PSD increments, visibility and acid deposition. The far-field analysis includes in-field (within the PAPA) analyses which are additional near-field impact assessments of field-wide source emissions for comparison to applicable ambient air quality standards and to PSD increments, and a mid-field (regional community) visibility impact assessment. This mid-field visibility assessment includes the regional communities of Boulder,

Cora, and Pinedale. Although these communities are classified as sensitive PSD Class II areas, no visibility protection exists under local, state, or federal law.

PSD Class I areas and sensitive PSD Class II areas analyzed in the far-field analyses include the following:

- Bridger Wilderness Area (Class I),
- Fitzpatrick Wilderness Area (Class I),
- North Absaroka Wilderness Area (Class I),
- Teton Wilderness Area (Class I),
- Washakie Wilderness Area (Class I),
- Grand Teton National Park (Class I).
- Yellowstone National Park (Class I),
- Gros Ventre Wilderness Area (Class II),
- Popo Agie Wilderness Area (Class II),
- Wind River Roadless Area (Class II).

Seven lakes within the PSD Class I and sensitive PSD Class II areas were identified as being sensitive to acid deposition. These lakes are those for which the most recent and complete data are available and include the following:

- Black Joe Lake in the Bridger Wilderness Area,
- Deep Lake in the Bridger Wilderness Area,
- Hobbs Lake in the Bridger Wilderness Area,
- Lazy Boy Lake in the Bridger Wilderness Area,
- Upper Frozen Lake in the Bridger Wilderness Area,
- Ross Lake in the Fitzpatrick Wilderness Area, and
- Lower Saddlebag Lake in the Popo Agie Wilderness Area.

The far-field analysis uses 3 years (2001, 2002, and 2003) of hourly windfields which were developed with the CALMET meteorological model for the modeling domain (Map 3.11-1). The CALPUFF dispersion model was used to model project alternative NO_x, SO_2, PM_{10}, and $PM_{2.5}$ emissions for each year of meteorology to estimate maximum potential air quality impacts. Detailed information regarding the modeling methodologies used in the analysis is provided in the Air Quality TSD.

Project emissions inventories were developed for the No Action Alternative and the Proposed Action Alternative. Annual emissions estimates were determined for each year over the LOP for both the No Action and Proposed Action alternatives based on estimates of field development provided by the Operators. Modeling scenarios were developed for each project alternative for the year with the maximum emissions. The maximum emissions scenarios include both construction and production activities. The maximum emissions year under the No Action Alternative is year 2007 and for the Proposed Action the maximum emissions are expected to occur in year 2009. For comparison purposes, an analysis of the PAPA in full production, after all construction activities have ceased (Year-2026), is also presented for the Proposed Action Alternative. The air emissions modeled for project sources in the far-field analysis are presented in Table 4.9-1 and a complete emissions inventories are provided in the Air Quality TSD (appendices F and G).

Table 4.9-1
Project and Non-Project Emissions (tpy) included in Far-field Analysis

Source Category	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Project Sources				
No Action Alternative	6,253.2	70.8	1,567.0	521.0
Proposed Action Alternative	5,885.1	79.3	1,158.3	469.0
Proposed Action Alternative – Maximum Field Production	2,424.9	2.5	1,149.2	391.4
Non-Project Sources				
RFD[1]	6,465.3	406.1	2,923.9	802.8
State-permitted and RFFA[1]	-2,574.6	110.7	476.4	476.4

[1] Reasonably foreseeable development (RFD) and reasonably foreseeable future actions (RFFA) are described in Section 4.9.3.

Comparison to Ambient Air Quality Standards and PSD Increments. The far-field analyses include impact assessments for comparison to applicable ambient air quality standards and for comparison to PSD increments. Predicted concentrations were added to the ambient background pollutant concentrations for comparison to the WAAQS and NAAQS. Ambient background concentrations were not added to modeled concentrations for comparison to PSD Class I and II increments. These comparisons are shown in Section 4.9.3.2 and in Appendix M.

Visibility. Far-field analyses assess potential change to regional haze at PSD Class I and sensitive PSD Class II areas. Regional haze is caused by light scattering and light absorption by fine particles and gases. Potential changes to regional haze were calculated in terms of a perceptible "just noticeable change in visibility" when compared to background conditions, expressed in deciviews (dv). The BLM considers a 1.0 dv change to be a significance threshold for visibility impairment, although there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies use a 0.5 dv change as a screening threshold for significance. The USFS and NPS compare direct project impacts to the 0.5 dv level, and those comparisons are included in the Air Quality TSD.

Predicted changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled concentration impacts to background visibility conditions representative of each PSD Class I or sensitive PSD Class II area. At the request of the BLM, WDEQ, and USFS, three separate visibility calculation methods were performed. Two additional visibility calculation methods were also performed (VISTAS, 2006). These methods follow recent CALPUFF modeling guidance for Best Available Retrofit Technology (BART) analyses developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization (RPO). The BLM and USFS requested methods that use visibility values provided in the FLAG Report for each PSD Class I area to represent natural background visibility. The WDEQ-AQD requested a method that uses representative monitoring data, for the quarterly average of the 20 percent best visibility days, collected from the IMPROVE network for the time period (2000 to 2004). This coincides with the time period that will be used to establish "baseline conditions" under the EPA Regional Haze Rule (EPA, 2003a). The two BART methods use background visibility conditions representative of each PSD Class I area as provided in the Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule (EPA, 2003b). Visibility impacts for the calculation method requested by BLM are presented in Section 4.9.3.2 and in Appendix M. These are compared to a 1.0 dv change, BLM's significance threshold for visibility impairment. All other visibility calculation methods and comparisons are detailed and presented in the Air Quality TSD.

Acid Deposition. Far-field analyses assess potential change to acid deposition and potential increase in acidification of acid sensitive lakes within the PSD Class I and sensitive PSD Class II areas. The USFS (Fox et al.,1989) has defined thresholds below which no adverse impacts from acid deposition are likely; however, the USFS has concerns that these deposition thresholds are set too high (Svalberg, 2006). These thresholds (herein referred to as levels of concern), defined as 3 kilograms per hectare per year (kg/ha-yr) for nitrogen and 5 kg/ha-yr for sulfur, are used for comparison of potential impacts from direct project impacts combined with background deposition values. CALPUFF predicted nitrogen and sulfur deposition impacts combined with background deposition values were compared to LOCs and are provided in Section 4.9.3.2 and in Appendix M. The NPS (2001) has identified Deposition Analysis Threshold (DAT) for total nitrogen and sulfur deposition in the western U.S. as 0.005 (kg/ha-year) for both nitrogen and sulfur. The DAT is used as an analysis threshold for evaluating potential impacts from project-related emissions. Comparisons of deposition impacts to the DAT are provided in the Air Quality TSD.

The USFS Rocky Mountain Region has developed a screening method (USFS, 2000) that identifies a LAC in lake chemistry. The LACs are 1) no more than a 10 percent change in ANC for lakes with an existing ANC greater than 25 microequivalents per liter (µeq/l) and 2) no more than a 1-µeq/l change for extremely acid-sensitive lakes where the existing ANC is less than or equal to 25 µeq/l. Of the seven lakes identified by the USFS as acid-sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid-sensitive. Predicted nitrogen and sulfur deposition values at acid sensitive lakes were used to estimate change in ANC for comparison to LAC and are provided in Section 4.9.3.2 and in Appendix M.

In-field Modeling. In-field analyses are additional near-field impact assessments of field-wide source emissions for comparison to applicable ambient air quality standards and to PSD increments and are provided in Section 4.9.3.2 and in Appendix M.

Mid-Field Modeling. Predicted changes to regional haze resulting from project source emissions were estimated for the regional community locations (Boulder, Cora, and Pinedale). Model predicted concentration impacts and recent (year 2005-2006) background visibility data collected at Boulder were used to estimate potential visibility impairment in these residential locations. Predicted visibility impacts were compared to the BLM 1.0 dv threshold and are provided in Section 4.9.3.2 and in Appendix M.

Pipeline Corridors and Rendezvous Pipeline

Construction of the proposed gas sales pipelines would result in intermittent and short-term emissions from the operation of diesel-fired heavy construction equipment.

While air emissions from fugitive dust and diesel combustion could occur at increased levels at locations adjacent to construction and development areas of these linear projects, potential impacts would be temporary and occur in isolation, and would not cause or significantly contribute to a violation of any applicable ambient air quality standard, or significantly impact AQRVs.

4.9.3.2 Alternative A (No Action Alternative)

Near-field Impacts. As shown in Appendix M (Tables M-1 through M-5), predicted near-field pollutant concentrations from the No Action Alternative sources are below the applicable WAAQS and NAAQS. Model predicted NO_2 concentrations are above the PSD Class II increment. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

The predicted acute and chronic (long-term) impacts are below applicable health-based levels for non-cancer compounds (Table M-5). Under both the MLE and MEI scenarios, the estimated incremental and combined cancer risk associated with long-term exposure to benzene and formaldehyde fall at the lower end of the 1 to 100 x 10^{-6} cancer risk range (Table M-7).

Far-field Impacts. Pollutant concentrations under the No Action alternative are below applicable ambient air quality standards (Tables M-8 through M-11).

Predicted impacts are below the applicable PSD increments (Tables M-12 through M-14).

Visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from No Action Alternative source emissions (Table M-16) are predicted to be above the "just noticeable visibility change" 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 62 days
- Fitzpatrick Wilderness Area 8 days
- Grand Teton National Park 2 days
- Gros Ventre Wilderness Area 6 days
- Popo Agie Wilderness Area 12 days
- Teton Wilderness Area 1 day
- Washakie Wilderness Area 2 days
- Wind River Roadless Area 9 days

There are no predicted impacts above the 1.0 dv threshold at any of the other analyzed sensitive areas.

Predicted maximum deposition impacts from the No Action Alternative (Tables M-18 and Table M-19) are well below the 3 kg/ha-yr (nitrogen)and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. The No Action Alternative source emissions do not result in a predicted increase in ANC above any LAC at acid-sensitive lakes (Table M-20).

In-field Impacts. Project related impacts are below applicable ambient air quality standards (Table M-15). Annual NO_2 concentrations are above the applicable PSD Class II increment. Modeled PM_{10} impacts are above the 24-hour PM_{10} increment and below the annual increment. Predicted SO_2 concentrations are below the applicable SO_2 increments. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

Mid-field Impacts. Visibility impacts at mid-field regional community locations from the No Action Alternative source emissions (Table M-17) were predicted to be above the 1.0 dv threshold for up to 126 days at Boulder, 89 days at Pinedale, and 58 days at Cora.

4.9.3.3 Alternative B (Proposed Action Alternative)

Near-field Impacts. As shown in Appendix M (Tables M-1 through M-5), predicted near-field pollutant concentrations from the Proposed Action Alternative sources are below the applicable WAAQS and NAAQS. Model predicted NO_2 concentrations are above the PSD Class II increment. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

Tables M-6 and M-7 summarize modeled HAP impacts based on emissions representative of the Proposed Action Alternative. The predicted acute and chronic (long-term) impacts are below applicable health-based levels for non-cancer compounds. Under both the MLE and MEI scenarios, the estimated incremental and combined cancer risk associated with long-term exposure to benzene and formaldehyde fall at the lower end of the 1 to 100 x 10^{-6} cancer risk range.

Far-field Impacts. Pollutant concentrations under the Proposed Action Alternative are below applicable ambient air quality standards (Tables M-8 through M-11).

Predicted impacts are below the applicable PSD increments (Tables M-12 through M-14).

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Proposed Action Alternative source emissions (Table M-16) are predicted to be above the "just noticeable visibility change" 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 67 days
- Fitzpatrick Wilderness Area 10 days
- Grand Teton National Park 3 days
- Gros Ventre Wilderness Area 8 days
- Popo Agie Wilderness Area 14 days
- Teton Wilderness Area 1 day
- Washakie Wilderness Area 2 days
- Wind River Roadless Area 10 days

There are no predicted impacts above the 1.0 dv threshold at any of the other analyzed sensitive areas.

Predicted maximum deposition impacts from the Proposed Action Alternative (Tables M-18 M-19) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. The Proposed Action Alternative source emissions are not predicted to result in an increase in ANC above any LAC at acid-sensitive lakes (Table M-20).

In-field Impacts. Project related impacts are below applicable ambient air quality standards (Table M-15). Predicted annual NO_2 concentrations are above the applicable PSD Class II increment. Modeled SO_2 and PM_{10} concentrations are below the applicable PSD increments. All NEPA PSD demonstrations are for information purposes only and do not constitute a regulatory PSD increment consumption analysis.

Mid-field Impacts. Visibility impacts at mid-field regional community locations from Proposed Action Alternative source emissions are predicted to be above the 1.0 dv threshold for up to 138 days at Boulder, 91 days at Pinedale, and 62 days at Cora (Table M-17).

4.9.3.4 Alternative C

Air quality impacts associated with Alternative C are similar to those for the Proposed Action Alternative; however, Alternative C includes two additional air quality modeling analyses that include mitigation to reduce visibility impacts:

- Phase I Mitigation is based on Year-2005 actual project emissions and the source locations of PAPA development activities that occurred during 2005. The analysis assumes Year-2005 actual emissions levels combined with the estimated PAPA source locations for Year-2009.

- Phase II Mitigation includes Year-2005 actual emissions levels with an additional 80 percent reduction in drilling rig emissions combined with the estimated source locations for Year-2009.

A discussion of the mitigation options is provided in Section 4.9.5. The results for these two model analyses are summarized below.

Near-field Impacts. Near-field impacts from Alternative C would be similar to the Proposed Action Alternative results shown in Appendix M (Tables M-1 through M-5).

Far-field Impacts. Pollutant concentrations under Alternative C are below applicable ambient air quality standards (Tables M-8 through M-11).

Predicted impacts are below the applicable PSD increments (Tables M-12 through M-14).

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase I mitigation (Table M-16) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 40 days
- Fitzpatrick Wilderness Area 5 days
- Grand Teton National Park 1 day
- Gros Ventre Wilderness Area 2 days
- Popo Agie Wilderness Area 6 days
- Wind River Roadless Area 5 days

Predicted impacts are less than the 1.0 dv threshold at any of the other analyzed sensitive areas.

Modeled visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase II Mitigation (Table M-16) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 10 days
- Fitzpatrick Wilderness Area 1 day
- Gros Ventre Wilderness Area 1 day
- Wind River Roadless Area 1 day

Predicted impacts are less than the 1.0 dv threshold at any of the other analyzed sensitive areas.

Predicted maximum deposition impacts from the Alterative C with mitigation (Tables M-18 M-19) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. Alternative C source emissions are not predicted to result in an increase in ANC above any LAC at acid sensitive lakes (Table M-20).

In-field Impacts. Table M-15 compares the maximum impacts from Alternative C (includes mitigation) to ambient air quality standards. Project related impacts are below applicable ambient air quality standards. Predicted annual NO_2 concentrations are above the applicable PSD Class II increment for the Alternative C Phase I Mitigation and are below the PSD increment for Alternative C Phase II Mitigation. Modeled SO_2 and PM_{10} concentrations are below the applicable PSD increments for Alternative C Phase I Mitigation and Alternative C Phase II Mitigation.

Mid-field Impacts. Visibility impacts at mid-field regional community locations from Alternative C Phase I Mitigation (Table M-17) are predicted to be above the 1.0 dv threshold for up to 107 days at Boulder, 70 days at Pinedale, and 47 days at Cora. Under Alternative C Phase II Mitigation, there are up to 45 days at Boulder, 25 days at Pinedale, and 12 days at Cora.

4.9.4 Cumulative Impacts

The CALPUFF model was used to quantify the impacts of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ resulting from cumulative emission sources associated with the project alternatives, state-permitted projects, reasonable foreseeable future actions (RFFA), and reasonably foreseeable development (RFD) located within the model domain (see Map 3.11-1). Project source emissions and other regional emissions included in the cumulative study are shown in Table 4.9-1. The cumulative study considers 2005 as a baseline year for emissions from non-project sources due to the availability of background air quality data for 2005 measured within and nearby the PAPA. The cumulative analysis assesses potential impacts to air quality that could occur beyond 2005 levels.

State-permitted projects include NO_x, SO_2 and/or PM_{10}/$PM_{2.5}$ sources that began operation after January 1, 2005, and were permitted before February 1, 2006. Projects permitted within the 18 months prior to January 1, 2005, but not yet operating were included as RFFA. RFD is defined as the undeveloped portion of 1) an approved NEPA project or 2) a proposed NEPA project for which quantified air emissions data were available at the time of the analysis. State-permitted projects, RFFA, and RFD emissions modeled in the cumulative analysis are quantified in Table 4.9-1. RFD projects included in the cumulative analysis are listed in Appendix M, Table M-21. RFD projects were analyzed utilizing the quantified proposed action emissions scenarios available in NEPA documents or the maximum production scenario identified for each project. Emissions from field development (the construction phase) of RFD were not analyzed for all projects because estimates were not available. The development phases of individual RFD projects have the potential to cause or contribute to higher localized ambient air impacts than those demonstrated in this analysis. RFD project development rates and schedules vary for each project and are difficult to define with certainty. Therefore, it was determined that emission sources operating at maximum production rates were the most reasonable representation of cumulative impacts occurring in the future, when based on RFD information available at the time of analysis.

While there may be additional gas processing and/or transmission requirements due to development within the PAPA and other natural gas projects regionally and nationally, the potential effects of these developments are not quantified herein because these developments are speculative and would require additional WDEQ/AQD permitting if they eventually are proposed. A portion of the Powder River Basin Oil and Gas Development Project (PRBP), located more than 200 kilometers east-northeast of the PAPA, is located within the far-field modeling domain defined in Map 3.11-1. A ratio of total PRBP field development equal to the geographical portion within the PAPA far-field modeling domain was included as RFD in this analysis. The PRBP identified significant project-specific and cumulative impacts in the Bridger Wilderness Area and other sensitive areas analyzed for this project. The air quality impacts associated with the PRBP have been described by BLM (2002b).

4.9.4.1 Alternative A (No Action Alternative)

As shown in Appendix M (Tables M-22 through M-28), cumulative pollutant concentrations from the No Action Alternative and regional source emissions are predicted to be below applicable ambient air quality standards and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts are below applicable ambient air quality standards at in-field locations (Table M-29).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from the No Action Alternative and regional source emissions (Table M-30) are predicted to be above the “just noticeable visibility change” 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 75 days
- Fitzpatrick Wilderness Area 13 days
- Grand Teton National Park 4 days
- Gros Ventre Wilderness Area 12 days
- North Absaroka Wilderness Area 1 day
- Popo Agie Wilderness Area 21 days
- Teton Wilderness Area 2 days

- Washakie Wilderness Area 2 days
- Wind River Roadless Area 12 days
- Yellowstone National Park 1 day

There are no predicted impacts above the 1.0 dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at mid-field regional community locations for the No Action Alternative and regional source emissions (Table M-31) are predicted to be above the 1.0 dv threshold for up to 141 days at Boulder, 94 days at Pinedale, and 65 days at Cora.

Predicted maximum cumulative deposition impacts from the No Action Alternative (Table M-32 and Table M-33) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all PSD Class I and sensitive PSD Class II areas. Cumulative emissions from the No Action Alternative and regional sources would not result in an increase in ANC above any LAC at acid-sensitive lakes (Table M-34).

4.9.4.2 Alternative B (Proposed Action Alternative)

As shown in Appendix M (Tables M-22 through M-28), predicted cumulative pollutant concentrations from the Proposed Action Alternative and regional source emissions are below applicable ambient air quality standards and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts are below applicable ambient air quality standards at in-field locations (Table M-29).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from the Proposed Action Alternative and regional source emissions (Table M-30) are predicted to be above the 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 77 days
- Fitzpatrick Wilderness Area 15 days
- Grand Teton National Park 5 days
- Gros Ventre Wilderness Area 12 days
- North Absaroka Wilderness Area 1 day
- Popo Agie Wilderness Area 25 days
- Teton Wilderness Area 2 days
- Washakie Wilderness Area 3 days
- Wind River Roadless Area 19 days
- Yellowstone National Park 1 day

There are no predicted impacts above the 1.0-dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at mid-field regional community locations from the Proposed Action Alternative and regional source emissions (Table M-31) are predicted to be above the 1.0 dv threshold for up to 153 days at Boulder, 96 days at Pinedale, and 68 days at Cora.

Predicted maximum cumulative deposition impacts from the Proposed Action Alternative (Table M-32 and Table M-33) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all sensitive PSD Class I and sensitive PSD Class II areas. Cumulative emissions from the Proposed Action Alternative and regional sources would not result in an increase in ANC above any LAC at acid-sensitive lakes (Table M-34).

4.9.4.3 Alternative C

As shown in Appendix M (Tables M-22 through M-28), predicted cumulative pollutant concentrations from the Alternative C Phase I Mitigation and Alternative C Phase II Mitigation, both with regional source emissions, are below applicable ambient air quality standards and PSD increments at all analyzed PSD Class I and sensitive PSD Class II areas. Predicted cumulative impacts are below are below applicable ambient air quality standards at in-field locations (Table M-29).

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase I Mitigation and regional source emissions (Table M-30) are predicted to be above the "just noticeable visibility change" 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 56 days
- Fitzpatrick Wilderness Area 7 days
- Grand Teton National Park 2 day
- Gros Ventre Wilderness Area 8 days
- Popo Agie Wilderness Area 14 days
- Teton Wilderness Area 1 day
- Washakie Wilderness Area 2 days
- Wind River Roadless Area 10 days
- Yellowstone National Park 1 day

Predicted impacts are less than the 1.0 dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at PSD Class I and sensitive PSD Class II areas resulting from Alternative C Phase II Mitigation and regional source emissions (Table M-30) are predicted to be above the "just noticeable visibility change" 1.0 dv threshold at the following locations:

- Bridger Wilderness Area 25 days
- Fitzpatrick Wilderness Area 4 days
- Grand Teton National Park 1 day
- Gros Ventre Wilderness Area 2 days
- Popo Agie Wilderness Area 6 days
- Wind River Roadless Area 6 days

Predicted impacts are less than the 1.0 dv threshold at any of the other analyzed sensitive areas.

Cumulative visibility impacts at mid-field regional community locations from Alternative C Phase I Mitigation and regional source emissions (Table M-31) are predicted to be above the 1.0 dv threshold for up to 118 days at Boulder, 79 days at Pinedale, and 60 days at Cora. For Alternative C Phase II Mitigation and regional source emissions, cumulative visibility impacts at mid-field regional community locations are predicted to be 69 days at Boulder, 45 days at Pinedale, and 25 days at Cora.

Predicted maximum cumulative deposition impacts from Alternative C Phases I and II Mitigation and regional sources (Table M-32 and Table M-33) are well below the 3 kg/ha-yr (nitrogen) and 5 kg/ha-yr (sulfur) LOC at all sensitive PSD Class I and sensitive PSD Class II areas. Cumulative emissions from Alternative C Phases I and II Mitigation and regional sources would not result in an increase in ANC above any LAC at acid-sensitive lakes (Table M-34).

4.9.5 Alternative Impact Mitigation

Air quality impact assessment modeling was conducted for existing conditions in the PAPA and the results are summarized in Chapter 3. The modeling analysis was based on Year-2005 actual emissions. Impact modeling results show 45 days of visibility impairment over 1.0 dv at Bridger Wilderness Area (see Appendix I).

Year-2009 (the maximum emissions year) for the Proposed Action Alternative was modeled for visibility impacts. Impact modeling results predict 67 days of visibility impairment over 1.0 dv at Bridger Wilderness Area.

Alternative C Phase I Mitigation would begin immediately after issuance of the ROD. Within 1 year of issuance of the ROD, Operators would be required to show a reduction in modeled visibility impacts to 2005 actual impact levels. This modeling would be based on modeling of Year-2009 Proposed Action emissions mitigated to 2005 actual emissions levels – a prediction of 40 days of visibility impairment over 1.0 dv at Bridger Wilderness Area. Modeled reductions are based on future year models, which include expanded development activities and development areas beyond what occurred during Year-2005. Therefore, modeling emissions levels that are reduced to 2005 levels shows modeling results (40 days over 1.0 dv) that are different from what was modeled for the PAPA during year 2005 (45 days over 1.0 dv). The reduction of modeled air quality impacts to 2005 levels would effectively mitigate the potential increase in visibility impacts for the Proposed Action Alternative. This reduction would be the starting point for further mitigation of the modeled visibility impacts of development that occurred in the PAPA since issuance of the PAPA ROD (BLM, 2000b) through 2005.

The objective for Alternative C Phase II Mitigation would be to achieve minimal days of predicted visibility impairment over 1.0 dv at Bridger Wilderness Area, with a goal of 0 days. Operators would be required to reduce visibility impact levels associated with modeling 20 percent drilling rig emissions reductions each year for the next 4 years after 2005 impact levels are achieved, within 1 year of issuance of the ROD. Modeling results using the BLM FLAG test for the Bridger Wilderness Area show that in Year 1, with 20 percent mitigation, impacts would be reduced to 35 days of visibility impairment over 1.0 dv. Further emissions reductions of 20 percent per year for the next 3 years would result in 23, 17, and 10 days, respectively, of modeled visibility impairment over 1.0 dv at Bridger Wilderness Area. The predicted impact levels are a result of reducing only drilling rig emissions by 20, 40, 60, and 80 percent, respectively. Reductions in compression and fugitive (well site, including well completions, and traffic) emissions as well as drilling rig emissions would further reduce predicted visibility impacts, however, there are limitations to obtain reductions in compression and fugitive emissions. Existing compression in the PAPA is BACT (best available control technology) as permitted through WDEQ-AQD. Most of the engines used in portable equipment during well completions have Tier 2 equivalent emissions. BLM modeled future emissions with the assumption that future compression would also use BACT. However, in order to achieve the goal of 0 days of visibility impairment, further emission reductions in these and other areas, in addition to the drilling rig emission reductions, may be required.

Predicted impact reduction by modeling is based on a reduction in drilling rig emissions, however, Operators would be able to reduce emissions from any source. The objective for mitigation is based on impact reduction (reduction in predicted visibility impairment) rather than reduction in specific emissions, such as NO_x. Implementation of one or more of the following examples would result in reduction of predicted visibility impact:

- natural gas-fired drilling rig engines;
- fuel additives;
- gas turbines rather than internal combustion engines for compressors;

- reduction in the number of drilling rigs;
- Tier 2 equivalent emissions drilling rig engines;
- selective catalytic reduction on drilling rig engines;
- electric drilling rigs;
- electric compression;
- centralization of gathering facilities to reduce truck traffic;
- cleaner technologies on completion activities, and other ancillary sources; and
- advancements in drilling technology.

The Operators should continue to innovate by demonstrating and using new techniques for controlling emissions to reduce potential visibility impact. Within 5 years after issuance of the ROD, the Operators must demonstrate annually through modeling that their plan to further reduce visibility impairment at the Bridger Wilderness Area is effective. If the goal of 0 days over 1.0 dv of modeled visibility impairment at the Bridger Wilderness Area cannot be demonstrated, the Operators, BLM, EPA, and WDEQ would jointly agree to a mitigation plan that complies with the goal, using any and all available means.

The method by which the Operators would determine project visibility impact would be determined by BLM in consultation with WDEQ, EPA, USFS, and NPS. BLM would rely on the Operators to determine how they would attain the reduction in visibility impacts from the PAPA.

At any time, BLM and/or the Operators may run air dispersion models to reassess air quality impacts. BLM would use the results of the model to assess whether the air quality impact objective and goal described in this Draft SEIS have been achieved.

4.10 NOISE

4.10.1 Scoping Issues

The following concern related to noise was submitted during scoping:

Use noise mitigation in crucial winter range.

4.10.2 Impacts Considered in the PAPA DEIS

Two noise sources were analyzed in the PAPA DEIS (BLM, 1999a) for potential impacts in the PAPA, a drilling rig and a compressor station. A background noise level of 39 dBA was assumed within the PAPA in 1999. Based on sound attenuation from the two sources, noise impact would become significant (greater than 49 dBA) when:

- a rig is located closer than about 800 feet to a receptor; and
- a compressor station is located closer than about 2,500 feet to a receptor.

With all of the potential compressor station sites farther than 2,500 feet from a residence, the PAPA DEIS (BLM, 1999a) concluded there would be no significant potential noise impacts to residences from compressor stations. There were potential well sites closer than 800 feet from a residence and significant noise impacts would be expected to occur at these locations. Noise from well flaring is very loud and occurs during the initial testing of the well, also periodically during well operation.

The PAPA DEIS (BLM, 1999a) considered noise impacts to greater sage-grouse leks from well drilling and operation but concluded noise would not be significant because well locations would be at least 1,320 feet (0.25 mile) from greater sage-grouse leks. However, compressor facilities located closer than 2,500 feet to a greater sage-grouse lek could significantly affect greater sage-grouse lek use. From these considerations, the BLM determined that significant impacts by noise would result from project related activities if noise levels are increased more than 10 dBA at any noise sensitive area (residences and greater sage-grouse leks). According to the significance criteria in the PAPA DEIS, significant impacts have most likely occurred.

4.10.3 Alternative Impacts

4.10.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Noise sensitive areas identified in the PAPA DEIS (BLM, 1999a) included greater sage-grouse leks, crucial big game habitat during crucial periods; residences within and adjacent to the PAPA; areas adjacent to the Lander Trail; ranches along both the New Fork and Green rivers; raptor nest sites when occupied; and recreation areas. The PAPA ROD (BLM, 2000b) set noise limits of new wellfield development so that distance to a dwelling or a greater sage-grouse lek would be sufficient to result in no noise level increase from operating facilities at the dwelling. It would not result in an increase greater than 10 dBA above background at the edge of a greater sage-grouse lek. In the PAPA DEIS, only wellfield traffic was considered as a potential noise source 0.25 mile away from greater sage-grouse leks because timing and geographic limitations on drilling were assumed to be enforced within 2 miles of greater sage-grouse leks from March 15 through July 15 (BLM, 2004c).

Noise associated with winter drilling was studied in 2006. The assumption was applied that noise generated by one drilling rig engine on a well pad would attenuate by 6 dBA for every doubling of distance from the source. With that assumption, distances at which engine noise would approximate background noise (with an assumed background of 39 dBA) would range from 1,717 feet to 8,944 feet (see Table 3.12-2). With the same assumptions, distances at which drilling engine noise would attenuate to 49 dBA (10 dBA above background) at noise sensitive sites (dwellings, greater sage-grouse leks) defined in the PAPA ROD ranged from 543 feet to 2,828 feet.

Leks attended by male greater sage-grouse near and within the PAPA have been intensively monitored from 1999 through 2005 (see Wildlife and Aquatic Resources, Section 4.20.3). The investigation indicated that male counts on leks that were heavily impacted by gas wells declined 51 percent from 1 year prior to well development in 1999 through 2004 (Holloran, 2005). Generally, the number of strutting males on leks decreased as distance to drilling rigs decreased. Numbers of strutting male also decreased with increased traffic volumes within 1.86 miles of the leks and increased noise intensity estimated at leks (Holloran, 2005).

Attenuation of noise from drilling rigs can exceed the 10 dBA limit above background noise at greater sage-grouse leks that was specified in the PAPA DEIS (BLM, 1999a) and carried through the PAPA ROD (BLM, 2000b) as an Administrative Requirement and Condition of Approval. Further, results of the long-term study on effects of wellfield development to greater sage-grouse lek attendance indicate that the 0.25-mile buffer surrounding leks, within which surface disturbance would be avoided (PAPA ROD), is insufficient to maintain function of lek habitats due to wellfield activities (road use, drilling) and associated noise (Holloran, 2005 and Ecosystem Research Group, 2006).

The PAPA DEIS (BLM, 1999a) established 800 feet as the distance at which noise between a sensitive receptor and drilling rig attenuate to 49 dBA (~10 dBA above ambient levels) and classified as a significant impact. However, noise studies in the PAPA (see Table 3.12-2) indicate that drilling noise may attenuate to 49 dBA up to 0.5 mile away from a drilling rig.

Therefore, significant impact could occur over 3.5 times the distance used to define impact significance in the PAPA DEIS.

Pipeline Corridors and Gas Sales Pipelines

Project related vehicles and construction equipment would generate noise while in operation during the construction of the gas sales pipelines. The noise would occur only during daylight hours, except for some highway vehicles which may be traveling over public roads in the minutes or hours preceding dawn and following dusk as workers return to work or lodging. The operation of the pipeline is not expected to generate noise, except for the regular small vehicle traffic associated with facility inspections.

4.10.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, restrictions would be retained on wellfield development within big game crucial winter ranges between November 15 and April 30. Consequently, noise generated by wellfield development would be limited to that associated with production (winter traffic) and compressors. The drilling of new wells would continue to be prohibited within 0.25-mile buffers surrounding residences and greater sage-grouse leks to minimize noise at those noise sensitive sites. Impact from noise to sensitive resources would continue at current levels.

4.10.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

Implementation of the Proposed Action Alternative would allow drilling during winter within big game crucial winter ranges. Seasonal protection of greater sage-grouse leks and nesting habitats that fall within areas subject to winter drilling under the Proposed Action Alternative would be subject to increased noise. The protections include:

- avoidance within a 2-mile radius of active leks from March 15 through July 15 (BLM, 2004c) to protect greater sage-grouse nesting habitat; avoidance of drilling; and
- avoidance of construction activities during the greater sage-grouse strutting period (March 1 through May 15) on areas within 1 mile of active leks as specified by the PAPA ROD (BLM, 2000b).

Noise within big game crucial winter ranges would increase overall under the Proposed Action Alternative through 2011. Noise at residences would increase within and adjacent to the PAPA during winter.

Proposed Action Alternative Through 2023

Increased noise during winter would continue through 2023 within big game crucial winter ranges and potentially near enough to other noise sensitive sites to cause significant impact.

4.10.3.4 Alternative C

Alternative C Through 2011

Under Alternative C, noise generated during winter would be concentrated within the southern 2 miles of DA-1 and within DA-2 and DA-4. Noise would exceed levels generated by the No Action Alternative in these locations. Unlike the Proposed Action Alternative, there would not initially be any new disturbances within the northern portion of DA-1 and within DA-3 in the winter. Noise at sensitive noise receptors (greater sage-grouse leks, big game crucial winter ranges, residences) in these areas would likely be at or near background levels except for noise associated with production activities.

Alternative C Through 2023

Wellfield development would progress from south to north within DA-1 within the mostly single Operator contiguous leaseholds. By 2017, wellfield development would be concentrated on the north end of DA-1. By that time and through 2023, winter drilling on big game crucial winter range would be limited to the north end of the PAPA within DA-1. Noise generated by winter drilling would be redistributed from south to north, affecting noise sensitive receptors (greater sage-grouse leks, big game crucial winter ranges, residences) at different locations until winter drilling has been completed. In areas where wellfield development is complete, noise during winter would only be associated with production activities.

Once all year-round drilling and wellfield development is complete within DA-2, development would commence in DA-3. With no additional winter drilling allowed, noise within DA-2 would be related to production. All liquids gathering systems would be in place so traffic related noise within DA-2 would be minimal.

Traffic and drilling in DA-3 would increase noise levels substantially during winter. Development would probably continue in DA-4 and extend into DA-5. Once there, however, Operators would be restricted by seasonal limitations on drilling between March 15 through July 15 (BLM, 2004c) to protect greater sage-grouse leks and nesting habitats.

4.10.4 Cumulative Impacts

The CIAA for noise extends outside the PAPA to some range, active rigs sometimes being audible for up to 20 miles (BLM, 2006a). This does not constitute a human health risk, but it would disturb wildlife to some extent, and does impact perceptions of the quality of the outdoor experience ("peace and quiet"). Traffic also contributes transient noise.

Noise is an unavoidable impact of development. There would be only small differences in overall noise in the PAPA between the alternatives though 2011, after which drilling would cease under the No Action Alternative. More noise would be generated during winter especially from drilling and well completions, by the Proposed Action Alternative and Alternative C. The Proposed Action Alternative and Alternative C extend drilling activity through 2023, although the number of rigs decreases through that period. The impacts of noise would depend not only on the number of drilling rigs operating, but also on their location relative to residences (particularly at night) or to recreational areas.

4.10.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate noise impact would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.11 GEOLOGY AND GEOLOGIC HAZARDS

4.11.1 Scoping Issues

The following concern related to Geology and Geologic Hazards was submitted during scoping:

Companies should be required to get more gas out of their existing wells before drilling additional wells.

4.11.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS, impact considered to Geology and Geologic Hazards by development in the PAPA included:

- seismic hazards, including direct hazards such as ground shaking and surface faulting and indirect hazards such as ground failure and liquefaction of water-saturated deposits such as sandy soils, alluvium and artificial fill, that would result in substantial damage to operating equipment; and
- landslides and/or slope failures resulting from wellfield development because of 1) inherent weakness in the composition or structure of rock or soils; 2) variation in the weather, such as heavy rain and snowmelt; and 3) human activity.

The PAPA DEIS concluded that implementation of BLM's Mitigation Guidelines would avoid development on slopes greater than 25 percent, and landslides or slumps should not result from project activities.

4.11.3 Alternative Impacts

4.11.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

In 2006, the PAPA is not a pristine area and current activities include active drilling, road, pad and pipeline construction, and traffic. Potential impacts to geology (geomorphology) include erosion and destabilizing slopes. To date, the control of erosion and sediment transport has consisted of adherence to stormwater management plans (SWPPPs), and berms and culverts where appropriate.

Tight gas sands such as the target formations in the PAPA require a high density of drilling to manage production, to not leave large blocks of the resource untapped and more difficult to access. In the last decade, drilling practices have developed so that a high density of drilling can be achieved from fewer pads, optimizing production while minimizing surface disturbance.

Production of the gas resource does deplete a non-renewable resource. BLM and the State of Wyoming management objectives associated with mineral resources are to enhance opportunities for their development, while protecting other resource values. There would be no interference with any other resource such as sand and gravel under any of the alternatives.

Pipeline Corridors and Gas Sales Pipelines

Pipeline construction within the proposed pipeline corridors would result in disturbance of underlying bedrock beneath deep to shallow soils. The disturbance would occur by excavation of softer and/or fractured bedrock and by blasting followed by excavation of harder, consolidated bedrock. The rock would be excavated and removed from the trench and it would be returned to the trench after the pipeline is placed in the open trench and is padded with protective finer grained sandy material. Construction activities should not cause slides due to the absence of active faults or slide surfaces in the immediate vicinity of the corridors. There would be only minor excavation into bedrock.

The terrain crossed by much of the proposed corridor system does not have steep slopes predisposed to mass movement. Areas with some susceptibility to mass movement of exposed soils and/or geologic substrate include the Blue Rim Area just south of the New Fork River. The R6 and PBC pipelines would cross the New Fork River at this location, but the potential for instability of geologic materials in such areas of steep slopes would be minimized by post-construction stabilizing measures and features, such as appropriately designed and constructed water bars and surface preparation.

Access to locatable or salable minerals would not be limited by corridor designation or pipeline construction due to the absence of such minerals and/or lack of proposed development of these resources near the proposed pipeline corridors. Access to preferred locations for oil and gas well development/drill locations could be compromised by pipeline construction and operation; however, there is flexibility in both the proposed well location and the pipeline alignment to a limited extent.

4.11.4 Cumulative Impacts

The CIAA for geology and geologic hazards is the PAPA. Cumulative impacts would be the same as those described for the proposed project under any of the alternatives.

4.11.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to geology and geologic hazards would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.12 PALEONTOLOGICAL RESOURCES

4.12.1 Scoping Issues

There were no project scoping comments related to Paleontological Resources.

4.12.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM stated that a significant impact to paleontological resources would occur if important fossils, which could substantially add to scientific understanding of paleontological resources, are destroyed. BLM concluded that all of the alternatives, except the *No Action Exploration/Development Scenario*, had the potential for uncovering or disturbing paleontological resources during construction and excavation of the project facilities. Further, improved access and increased visibility may cause fossils to be damaged or destroyed due to unauthorized collection and vandalism. It is not known if paleontological resources have been significantly impacted by existing development within the PAPA.

4.12.3 Alternative Impacts

4.12.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Since the PAPA DEIS (BLM, 1999a) was written, all paleontological discoveries within the PAPA have been made in the badlands and outcrops associated with Blue Rim and Ross Butte. Consequently, analyses of potential effects by each alternative focus on surface disturbances within the Blue Rim Area of the Sensitive Soils SRMZ, discussed below in Soil Resources, Section 4.15, and enumerated in Table 4.15-1 where future paleontological discoveries and potential for impact would probably occur. The potential for significant impact would increase as additional development is implemented under each of the alternatives.

Pipeline Corridors and Gas Sales Pipelines

Construction of the gas sales pipelines would likely disturb unconsolidated and, to a lesser extent, consolidated bedrock by trenching in areas of moderately deep to shallow soils. Such disturbance of bedrock would have the potential to damage undiscovered, scientifically-significant fossils. Such disturbance could also result in the exposure and discovery of fossils that may add to the understanding of the area's paleontological resources.

Discovery of fossils during construction would result in the suspension of construction activities to prevent further disturbance and/or damage to the fossil resource. The discovery would result in the immediate reporting of the find to the BLM's AO for a determination of significance and possible recommendation for recovery or avoidance

4.12.3.2 Alternative A (No Action Alternative)

Continued development in the PAPA under the No Action Alternative would likely nearly double the amount of existing wellfield disturbance within the Blue Rim Area of the Sensitive Soils SRMZ by increasing the current level of disturbance from 590 acres to potentially more than 1,100 acres (see Table 4.15-1). Such disturbance could lead to increased impact and/or paleontological discoveries.

4.12.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

Continued development in the PAPA under the Proposed Action Alternative through 2011 would lead to considerably more surface disturbance, possibly 1,000 acres, within the Blue Rim Area of the Sensitive Soils SRMZ compared to project disturbance under the No Action Alternative (Table 4.15-1). This amount of disturbance could lead to increased impact and/or discovery of paleontological resources.

Proposed Action Alternative Through 2023

Under the Proposed Action Alternative through 2023, surface disturbance expected in the Blue Rim Area would nearly triple the existing amount of disturbance in 2006. Consequently, there is the potential for significant impact to paleontological resources by the Proposed Action Alternative.

4.12.3.4 Alternative C

Alternative C Through 2011

Development in the PAPA under Alternative C through 2011 is expected to increase existing disturbance by more than 700 acres within the Blue Rim Area of the Sensitive Soils SRMZ (Table 4.15-1). However, potential disturbance could be 200 acres less than disturbance by the

Proposed Action in 2011. As with the Proposed Action Alternative, the increase in disturbance could lead to increased impact and/or discovery of paleontological resources.

Alternative C Through 2023

Disturbance under Alternative C through 2023 would be similar to the Proposed Action through 2023. Like the Proposed Action Alternative, disturbance in the Blue Rim Area would nearly triple the existing amount of disturbance in 2006 (Table 4.15-1). Consequently, there is the potential for significant impact to paleontological resources by Alternative C.

4.12.4 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to paleontological resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.12.5 Cumulative Impacts

The CIAA for paleontological resources is the PAPA. Cumulative impacts would be the same as those described for the Blue Rim Area of Sensitive Soils in Table 4.15-2, below. While there had been limited surface disturbances by non-wellfield disturbance in the Blue Rim Area, existing and projected surface disturbance under all alternatives is likely to disturb between 1,000 and 2,000 acres and increase the likelihood of cumulative impact to paleontological resources.

4.13 GROUNDWATER RESOURCES

4.13.1 Scoping Issues

The following comment addressing Groundwater Resources was received during scoping:

Concern about aquifer contamination by drilling and fracturing, BLM should provide methods to prevent, mitigate, and monitor impact to groundwater.

4.13.2 Impacts Considered in the PAPA DEIS

The PAPA DEIS (BLM, 1999a) considered various potential impacts to Groundwater Resources during future wellfield development in the PAPA. Those impacts include:

- the subsurface could be affected by groundwater withdrawals and wastewater injection;
- anticipated impacts consist of drawdown in aquifers from which water is extracted for drilling;
- there could also be loading of deeper receiving zones by wastewater injection;
- there is the potential for contamination of aquifers during drilling, completion, and production of the gas wells through drilling/fracturing fluids and/or produced water;

- there is the potential for shallow aquifers to be contaminated by leakage from the reserve pit and by onsite water wells with alkaline pH's; and
- drilling and completion techniques of water wells needs to be changed to correct the alkalinity problem.

The PAPA DEIS (BLM, 1999a) addressed injection of produced water, however, there currently are no injection wells within the PAPA and there are none included in any of the alternatives. However, Operators and others are currently investigating permitting wells for deep injection of produced water in the PAPA. In the PAPA DEIS, BLM considered potential impacts from an injection well to be insignificant because the well must be permitted with the WOGCC. The agency's rules and regulations require that the Operator demonstrate that the proposed disposal operation would not endanger fresh water sources. The disposal well must be cased and cemented in such a manner that damage would not be caused to oil, gas, or fresh water sources. The Operator must also demonstrate mechanical integrity of the well at least every 5 years and, if tests fail, the well must be repaired, shut-in, or operated at a reduced injection pressure.

Similarly, BLM cited adequate regulations were in place to protect shallow aquifers:

- Significant impact to the aquifer from drilling and completion fluids and produced water are not likely because all production wells would be cased and cemented to protect subsurface mineral and freshwater zones according to WOGCC rules and regulations.
- Wells that are no longer productive would be plugged and abandoned according to procedures outlined in the WOGCC's rules and regulations.
- Contamination of shallow aquifers from reserve pits is unlikely because the reserve pits would be lined and would be constructed in cut areas or in compacted and stabilized fill in accordance with WOGCC rules.
- If the quality of groundwater becomes unacceptable for any purpose, other water supply sources would be investigated and permitted through the appropriate agency.

In the PAPA DEIS (BLM, 1999a), BLM considered that impacts to groundwater supplies or springs would be significant if:

- the natural flow of water to local springs is interrupted;
- new water supply wells that are first tested with a neutral pH (about 7.0) later become significantly alkaline (pH 8.0 to 10) after pumping;
- groundwater quality is degraded so that it can no longer be classified for its current use; or
- the water table is lowered, as a result of drilling water withdrawals, to a level that would require replacement or deepening of other groundwater wells in the project area.

Based on the significance criteria stated above, significant impacts to groundwater have not occurred.

4.13.3 Alternative Impacts

4.13.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Potential impacts to groundwater quality include accidental spills of petroleum products or other pollutants and cross-aquifer mixing. Potential impacts to groundwater quantity are those resulting from withdrawals of groundwater from the Wasatch aquifer and include:

- lowering water levels in aquifers used by domestic and stock wells;
- depletion of Wasatch aquifer (drilling water supply source);
- depletion of groundwater discharge to surface waters; and
- cross contamination of aquifers.

Groundwater quality could be impacted by leaky well seals allowing cross-aquifer contamination, or by leaks and spills from trucks or other equipment on the well location. Ensuring good well seals across aquifer boundaries would prevent cross-aquifer contamination. Detection of water quality impacts would require notification of WDEQ-WQD and appropriate remedial action. Potential for leak and spill impacts and appropriate responses would be addressed in the Operator's individual Spill Prevention Countermeasure and Control (SPCC) Plans.

Lowering of water levels and cross-contamination of aquifers are preventable by sound well construction practices required by permits to drill, which state that isolation of aquifers will be maintained by ensuring good cement seals in gas production wells. All gas production wells have the annulus cemented to surface, and cement bond logs are run to confirm the cement integrity across formation contacts. The PAPA ROD (BLM, 2000a) required that open intervals of water wells be at least 200 ft deeper than any domestic or stock well within one-half mile. These provisions are meant to prevent communication between shallow and Wasatch aquifers. Temporary depletion of the Wasatch aquifer is a consequence of groundwater extractions for drilling water through water supply wells. The projected annual usage is a fraction of the annual recharge through infiltration, and less than 1 percent of the storage of the Wasatch. Water level recovery in the Wasatch should therefore be rapid when pumping ceases in any area. There are only a few domestic wells completed in the Wasatch.

A model is provided in Appendix N of likely impacts to the Wasatch aquifer due to a dense cluster of drilling rigs and associated water supply wells. The model is based on typical Wasatch hydraulic properties and a typical configuration of wells. The model suggests that up to 10 feet drawdown may be expected up to 3 miles from such a concentration of activity. No more than 30 feet drawdown is expected in the Wasatch within 1.5 miles of any drilling rig.

Recovery of water levels in the Wasatch after drilling and groundwater extraction cease should be rapid. Numerical modeling in the Jonah Field indicated full recovery in the case of the most aggressive development within 6 years. This estimation is particularly sensitive to recharge from above and within the Wasatch. Groundwater use under any of the alternatives is a fraction of the average vertical recharge (see Section 3.15).

WDEQ-Water Quality Division (2005b) voiced concern that the current Groundwater Monitoring Program conducted by SCCD does not attempt to map or distinguish various aquifers within the Wasatch, which rendered monitoring of an inconsistent target very uncertain.

Much of the variability in the Wasatch aquifer results from its being composed of many stacked and discontinuous sands, deposits of wandering early Tertiary rivers, so that water supply wells encounter and draw water from different units in different locations. Sands are so variable they can rarely be interpolated between holes on quarter-section spacing. This means that it is not practical to map individual water producing sand units, and it is practical only to monitor the Wasatch as a heterogeneous aquifer in an average sense.

The Operators, in cooperation with BLM and WDEQ-WQD, are drafting a revised groundwater monitoring plan to ensure detection of impacts to Wasatch or shallow alluvial groundwater. This would refer to, but not include, SPPC Plans and SWPPPs. The proposal for the revised monitoring plan is provided in Appendix O.

The Wasatch aquifer both recharges and discharges in the PAPA, that is, it receives some infiltration from precipitation and some of its groundwater enters surface water in the tributaries of the Green River. Depletion of the Wasatch could decrease this local contribution to streamflow. This potential could be addressed by the installation of a number of alluvial monitoring wells in watercourses in the PAPA above the influence of the Green and New Fork rivers. Water levels would be measured on a monthly basis for 1 year to assess the seasonal and baseflow components of alluvial flow coming off the PAPA. Groundwater seepage typically supplies a minimum baseflow (surface water and or alluvial groundwater) throughout the year, and local flow generated by seasonal precipitation superimposes a local variable but cyclic component. When baseflow has been established, impacts due to depletion of the Wasatch should be discernible in the monitoring wells. Mitigation of baseflow depletion would consist of augmenting the streamflow by pumping groundwater to infiltration basins in an affected watercourse. Alluvial wells would also monitor for any increase in salinity in discharge to surface water.

Various drilling and production scenarios are well specified under the alternatives, but hydraulic characteristics of the aquifers are not, and so comparisons of impacts to groundwater resources cannot be precise. Impacts to the Wasatch with greater drilling activity would be greater than the current scenario, but these impacts should not affect stock and domestic wells if effective well seals are maintained. Operators are increasing the re-use of produced water and therefore, there is the potential for groundwater withdrawals to decrease under each of the alternatives over time. Relative impacts to groundwater can be gauged by a comparison of total water usage by each alternative as discussed below. Based on the significance criteria in the PAPA DEIS, it is not expected that significant impacts to groundwater would occur under any of the alternatives.

<u>Pipeline Corridors and Gas Sales Pipelines</u>

The establishment of the proposed corridors and subsequent construction and operation of pipelines is not expected to result in any impacts to groundwater resources. The depth to groundwater would preclude adverse effects from pipeline construction and operation. No toxic substances are proposed for use during pipeline construction. The pipelines would be hydrostatically tested for any leaks prior to entering service to ensure the absence of any leakage of natural gas. Any spills of fuel, lubricants, and solvents during pipeline/facility construction would be contained and cleaned up in accordance with SPCC Plan requirements.

4.13.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, it is estimated that an additional 1,139 wells would be drilled in the PAPA through 2011. This would require approximately 2,280 acre-feet of water for drilling and completions.

4.13.3.3 Alternative B (Proposed Action Alternative)

Under the Proposed Action, it is estimated that an additional 1,453 wells would be drilled through 2011 requiring 2,900 acre-feet of water. This represents 27 percent more water under the Proposed Action Alternative than for the No Action Alternative. By 2023, an additional 4,399 wells would be drilled requiring 8,800 acre-feet of water.

4.13.3.4 Alternative C

Groundwater withdrawals for drilling and completion would be the same as those described above for the Proposed Action Alternative.

4.13.4 Cumulative Impacts

The CIAA for groundwater is the PAPA. Drawdown in the Wasatch should be less than 1 foot at any time on the perimeter of the PAPA. Therefore, it is not likely that groundwater resources would be affected outside the PAPA as a result of the groundwater uses within the PAPA. Cumulative impacts to groundwater would be the same as those described for each of the alternatives.

4.13.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to groundwater would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, the Operators provided the measures included in Attachments 1 through 4 in Appendix C.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.14 SURFACE WATER

4.14.1 Scoping Issues

The public expressed two concerns about surface water during scoping. They were that BLM should:

1. Evaluate potential for impacts to downstream water users including heavy metals in produced waters.
2. Ensure that reclamation is timely, successful, and appropriate to benefit wildlife.

4.14.2 Impacts Considered in the PAPA DEIS

Because the New Fork and Green rivers flow through the PAPA, the PAPA DEIS (BLM, 1999a) recognized that potentially significant impacts could occur to water quality from increased erosion and sedimentation from construction related runoff (i.e., non-point source pollutants). BLM also noted the potential impact (increased sedimentation) to water quality from discharge of hydrostatic test water during pipeline testing. Hydrostatic test water, though, was not expected to produce significant impacts because it would be short-term in nature and the Operators would be required to comply with WDEQ/WQD regulations. There could be water quality impacts from accidental spills. Depending on where such a spill occurred, the impacts could be significant.

Impacts from sedimentation would not be significant if the Operators strictly comply with BLM's Mitigation Guidelines, apply relevant stormwater Best Management Practices (BMPs), and implement appropriate mitigation measures described in the PAPA DEIS. If significant impacts to area waters from sedimentation are to be avoided, attention to control of non-point sources of sediment will be necessary. In the PAPA DEIS, impacts produced by the alternatives would be considered significant should any of the following occur:

- Construction related erosion and runoff into intermittent drainages and subsequently into perennial streams, altering the physical characteristics of streambeds;

- Construction related erosion and leaching of exposed subsoils, releasing increased flux of salts into perennial streams and degrading the quality of water;
- accidental spill of fuels or liquids associated with drilling, construction, or production activities affects the quality of surface water; or
- an increase in sediment loading causes any of the rivers or streams to be identified as a water which does not support its designated use.

Based on these significance criteria, it is not known if significant impact has occurred to surface water.

4.14.3 Alternative Impacts

4.14.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Surface Water Withdrawals. Table 4.14-1 shows the amount of surface withdrawal required within the PAPA under each of the alternatives for the life of the project. Direct impacts to Colorado River endangered fish species could occur as a result of surface water withdrawal in the PAPA. A discussion of the Recovery and Implementation Program (RIP) for Endangered Fish Species in the Upper Colorado River Basin is provided in Section 4.19.3.1. Surface water would be withdrawn from the New Fork River for hydrostatic testing of trunk pipelines, gas and liquid gathering pipelines, and for dust control during pipeline construction.

Table 4.14-1
Estimated Surface Water Withdrawals from the New Fork River for Life of Project within the PAPA by Alternative

Water Use	Surface Water Withdrawal (acre-feet)				
	No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Pipeline Hydrostatic Testing					
Gas gathering	2.51	2.21	2.06	2.82	2.79
Liquid gathering	0.06	2.49	2.50	3.12	3.12
30-inch Mesa loop	8.51	8.51	8.51	8.51	8.51
10-inch water trunk line	1.51	1.51	1.51	1.51	1.51
12-inch gas line	0.74	0.74	0.74	0.74	0.74
Liquid gathering trunk lines	0.00	0.19	0.19	0.19	0.19
Water redistribution lines	0.00	0.14	0.14	0.14	0.14
Pipeline interconnection	0.00	0.40	0.40	0.40	0.40
Dust Control During Pipeline Construction	12.08	30.63	30.21	37.13	37.05
Total	**25.41**	**46.82**	**46.26**	**54.56**	**54.45**

Surface Water Discharges. Produced water is managed in several ways within the PAPA. Mostly, produced water is piped or trucked to the Anticline Disposal facility or other water treatment facility. Some is re-used in well completions (drill-out of the production zone, or fracturing). Produced water used for drilling is only used after isolation casing has been installed through the fresh water zone. After treatment, some produced water is re-used for dust control. These uses are increasing, and re-use of the water reduces the demand on the Wasatch water supply. Some produced water and treatment plant reject is disposed of in permitted deep injection wells, none of which is in the PAPA. However, Operators and others are currently investigating possibilities for deep injection within the PAPA. Currently, produced water is not discharged within the PAPA; however, Anticline Disposal has a permit to discharge (up to 1 cfs) water that is treated to WDEQ standards. The discharge would be to the New Fork River and is planned to begin in 2007.

Gray water is treated on site by a third-party and is disposed of by sprinkler (WDEQ permit has been acquired for the discharge). Impacts to surface water could occur if the discharge were allowed to reach surface water, which is not allowed under the permit. Flows are limited under the permit to prevent erosion.

Impacts Resulting from Disturbance. Potential direct impacts to surface water include increased salinity, turbidity, and sedimentation in surface waters as a result of surface disturbance. These impacts are a result of runoff and erosion, leaching of soil salts, or by increased salinity in groundwater discharging to streams. Increased salinity in surface water is a concern in regard to the Colorado River Basin Salinity Control Act (see Section 3.16.1.1).

Implementation of each alternative is expected to concentrate additional surface disturbance within New Fork River-Alkali Creek, Mack Reservoir and Sand Draw-Alkali Creek sub-watersheds by the end of 2011; in some cases, an alternative could potentially more than double or nearly triple the existing surface disturbed by 2011 (Table 4.14-2). Continued development through 2023 by either the Proposed Action Alternative or Alternative C could increase disturbed areas in the New Fork River-Alkali Creek and Mack Reservoir sub-watersheds by more than 300 percent of existing disturbance levels (Table 4.14-3).

Table 4.14-2
Surface Disturbance in Relation to Sub-Watersheds by Alternative

Sub-Watershed and Hydrologic Unit Code	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Green River-Tyler Draw 140401010403	21.7	45.0	45.0	45.0	45.1	45.0
Green River-The Mesa 140401010404	10.1	7.5	7.5	7.5	7.5	7.5
Sand Draw-Alkali Creek 140401010701	502.2	519.0	427.1	444.7	1,076.8	1,277.1
Granite Wash 140401010704	0.0	0.0	0.0	0.0	0.0	0.0
North Alkali Draw 140401010705	116.5	150.9	98.6	133.6	231.6	275.7
New Fork River-Duck Creek 140401020102	92.4	141.1	38.6	38.6	181.0	114.7
Hay Gulch 140401020105	3.9	0.0	0.0	0.0	0.0	0.0
Lower Pine Creek 140401020203	3.7	0.0	0.0	0.0	0.0	0.0
New Fork River-Stewart Point 140401020301	361.9	191.3	207.6	207.6	934.3	878.6
East Fork River 140401020302	12.0	0.0	0.0	0.0	0.0	0.0

Sub-Watershed and Hydrologic Unit Code	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
New Fork River-Alkali Creek 140401020303	2,353.6	2,230.4	3,885.8	4,230.1	6,189.1	6,040.4
Sand Springs Draw 140401020304	81.3	5.2	93.3	102.4	240.4	336.4
New Fork River- Blue Ridge 140401020305	228.8	136.3	251.0	217.8	533.5	505.3
Mack Reservoir 140401020306	850.3	938.5	1,593.7	1,232.5	2,642.3	2,499.7
Lower Pole Creek 140401020403	0.9	0.0	0.0	0.0	0.0	0.0
South Muddy Creek 140401020602	0.0	0.0	0.0	0.0	0.0	0.0
Lower Muddy Creek-New Fork 140401020603	0.0	7.0	7.0	7.0	7.0	7.0
Big Sandy River-Waterhole Draw 140401040105	1.5	2.7	0.3	0.3	0.3	0.3
Big Sandy River-Bull Draw 140401040106	74.2	10.9	34.5	34.5	34.5	34.5
Mud Hole Draw 140401040107	344.4	98.7	155.0	155.0	155.0	249.4
Long Draw 140401040109	0.0	0.0	0.0	0.0	0.0	0.0
Total	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**

Table 4.14-3
Modeled Average Annual Sediment Yields of Sub-Watersheds by Alternative

Sub-Watershed and Hydrologic Unit Code	Sediment Loss (kg/ha)				
	Pristine No Disturbance	Current Conditions 2006	No Action Alternative 2011	Proposed Action and Alternative C 2011	Proposed Action and Alternative C 2023
Green River-Tyler Draw 140401010403	1.55	1.55	1.57	1.57	1.57
Green River-The Mesa 140401010404	1.46	1.46	1.46	1.46	1.46
Sand Draw-Alkali Creek 140401010701	0.16	0.19	0.21	0.20	0.24
Granite Wash 140401010704	N/A-	N/A	N/A	N/A	N/A
North Alkali Draw 140401010705	1.65	2.05	2.49	2.62	2.70
New Fork River-Duck Creek 140401020102	0.04	0.04	0.04	0.04	0.04
Hay Gulch 140401020105	N/A-	N/A	N/A	N/A	N/A
Lower Pine Creek 140401020203	0.01	0.01	0.01	0.01	0.01
New Fork River-Stewart Point 140401020301	0.25	0.33	0.35	0.34	0.47

Sub-Watershed and Hydrologic Unit Code	Sediment Loss (kg/ha)				
	Pristine No Disturbance	Current Conditions 2006	No Action Alternative 2011	Proposed Action and Alternative C 2011	Proposed Action and Alternative C 2023
East Fork River 140401020302	0.74	0.74	0.74	0.74	0.74
New Fork River-Alkali Creek 140401020303	0.51	0.67	0.95	0.99	1.16
Sand Springs Draw 140401020304	0.02	0.02	0.02	0.02	0.02
New Fork River- Blue Ridge 140401020305	1.13	1.13	1.16	1.14	1.28
Mack Reservoir 140401020306	0.39	0.44	0.71	0.56	0.89
Lower Pole Creek 140401020403	N/A-	N/A	N/A	N/A	N/A
South Muddy Creek 140401020602	N/A-	N/A	N/A	N/A	N/A
Lower Muddy Creek-New Fork 140401020603	N/A-	N/A	N/A	N/A	N/A
Big Sandy River-Waterhole Draw 140401040105	0.14	0.15	0.15	0.15	0.15
Big Sandy River-Bull Draw 140401040106	0.68	0.70	0.70	0.70	0.70
Mud Hole Draw 140401040107	0.33	0.39	0.40	0.41	0.41
Long Draw 140401040109	N/A-	N/A	N/A	N/A	N/A
N/A= not analyzed-due to minimal disturbance					

Modeling was conducted by HydroGeo, Inc. for sediment loss in the PAPA and transport (load) to the PAPA boundary for all sub-watersheds in the PAPA. *The Erosion Modeling, Sediment Transport Modeling and Salt Loading Technical Report, Pinedale Anticline Project Sublette County, Wyoming* is provided in Appendix J. The watersheds were modeled for individual storms of varying size, with the amount of erosion proportional to the size of the storm, for seven scenarios:

- a pristine case (no disturbance or development in the PAPA);
- current conditions in the PAPA;
- No Action Alternative 2011;
- Proposed Action 2011;
- Proposed Action 2023;
- Alternative C 2011; and
- Alternative C 2023.

Modeled impacts for each scenario were assessed for new disturbance above and beyond that of the current condition. Disturbance was assumed to accumulate and not be reclaimed in this model, so it represents a worst case.

The greatest erosion impacts occur on the Anticline Crest under all alternatives. Mack Reservoir and New Fork River-Alkali Creek sub-watersheds show the largest increase in annual erosion over the current conditions. Erosion is increased as well in Sand Draw-Alkali Creek sub-watershed for large storms. Modeled average annual sediment yields in the PAPA sub-watersheds are provided in Table 4.14-3 and the percent increases of sediment yield for each of the alternatives is provided in Table 4.14-4.

Table 4.14-4
Average Annual Sediment Yield Increase (%)
above Current Conditions for Sub-Watersheds by Alternative

Sub-Watershed and Hydrologic Unit Code	Percent of PAPA Area	No Action Alternative 2011	Proposed Action and Alternative C 2011	Proposed Action and Alternative C 2023
Green River-Tyler Draw 140401010403	4.46	1.29	1.29	1.29
Green River-The Mesa 140401010404	3.68	0.00	0.00	0.00
Sand Draw-Alkali Creek 140401010701	4.55	10.53	5.26	26.32
Granite Wash 140401010704	0.55	N/A	N/A	N/A
North Alkali Draw 140401010705	5.03	21.46	27.80	31.71
New Fork River-Duck Creek 140401020102	2.79	0.00	0.00	0.00
Hay Gulch 140401020105	0.12	N/A	N/A	N/A
Lower Pine Creek 140401020203	0.64	0.00	0.00	0.00
New Fork River-Stewart Point 140401020301	8.69	6.06	3.03	42.42
East Fork River 140401020302	2.47	0.00	0.00	0.00
New Fork River-Alkali Creek 140401020303	25.01	41.79	47.76	73.17
Sand Springs Draw 140401020304	6.67	0.00	0.00	0.00
New Fork River- Blue Ridge 140401020305	12.58	2.65	0.88	13.27
Mack Reservoir 140401020306	7.75	61.36	27.27	102.27
Lower Pole Creek 140401020403	0.89	N/A	N/A	N/A
South Muddy Creek 140401020602	2.08	N/A	N/A	N/A
Lower Muddy Creek-New Fork 140401020603	0.75	N/A	N/A	N/A
Big Sandy River-Waterhole Draw 140401040105	1.69	0.00	0.00	0.00
Big Sandy River-Bull Draw 140401040106	2.91	0.00	0.00	0.00
Mud Hole Draw 140401040107	6.53	2.56	5.13	5.13
Long Draw 140401040109	0.16	N/A	N/A	N/A
N/A= not analyzed-due to minimal disturbance				

Rates of erosion and sediment transport in the PAPA are currently low, because relatively gentle slopes predominate, and runoff from much of the PAPA occurs only during large storm events. Measurable increases in sediment in the New Fork River are predicted only for 25-year or larger storms (a 25-year storm is of a magnitude that occurs on average every 25 years).

Smaller storms mobilize significant sediment on disturbed land, but it tends to be redeposited in lower watercourses before leaving the PAPA. Increased disturbance causes higher sediment yield in all scenarios in large storms.

Reclamation would significantly reduce these estimates of sediment yield. Instituting best management practices for erosion and sediment transport control would further diminish impacts.

The reason that some watersheds show greater erosion and sediment yield under the No Action Alternative than under the Proposed Action Alternative (for instance the Mack Reservoir) is that development in the particular watershed in the No Action Alternative is concentrated on higher slopes, whereas it is spread out and on lower slopes in the Proposed Action Alternative.

According to the significance criteria in the PAPA DEIS, significant impact to surface water resources is not expected under any of the alternatives.

Pipeline Corridors and Gas Sales Pipelines

Potential impacts to surface water resources from pipeline construction could include short-term increased turbidity, salinity, and sedimentation of surface waters. This would occur during seasonal flows or precipitation events due to increased runoff and accelerated erosion from disturbed upland areas, and depletion of Green River tributary waters for hydrostatic testing. Clearing and blading followed by construction vehicle travel across ephemeral stream channels could break down stream banks, cause or accelerate erosion, increase sediment loads, and destabilize the channels. However, vehicle access to the pipeline rights-of-way would be confined to existing access roads and to the construction rights-of-way (for the duration of construction activities). No new roads would be constructed. Vehicles would also not operate when soils are saturated to avoid rutting and associated excessive soil compaction and enhanced conditions for accelerated erosion. Implementation of approved reclamation measures that extend to ephemeral stream banks and bottoms would also enhance bank stability and limit excessive channel erosion and sedimentation when stream flows again.

No toxic substances are proposed for use during pipeline construction. The pipelines would be hydrostatically tested for any leaks prior to being placed in service. Any spills of fuel, lubricants, and solvents during pipeline/facility construction in the corridors that could be entrained by surface soils materials and/or enter into surface waters or drainages would be contained and cleaned up in accordance with SPCC Plan requirements.

Direct impacts to perennial waterbodies would be minimized by crossing using HDD construction methods. In HDD construction, disturbance is set back away from the river edges and typically above any flood plains that may be present. Increased contributions of sediment to the rivers from affected ephemeral tributaries would be mitigated by measures implemented at ephemeral stream crossings and in compliance with an approved reclamation plan.

Accidental leaks from the proposed natural gas pipelines would likely have negligible impact on surface water quality due to the minor amount of liquids present in the pipelines. Other pipelines in the corridors may carry more hydrocarbon liquids or possibly product. Those future pipelines could have more of an adverse impact on water quality should they leak. The principal risks of pipeline operations that could lead to leaks/releases include excessive pressure, physical damage during flood events and from accelerated soil erosion and pipe corrosion. Pipeline failures due to excess pressure would be prevented by proper engineering design and incorporation of pressure relief valves. The pipeline would be monitored through periodic leakage surveys and patrols to anticipate and correct problems before failures occur.

Approximately 33.4, 43.0, and 29.3 acre-feet of water would be withdrawn from the New Fork, Green, and Blacks Fork rivers, respectively, for hydrostatic testing of the proposed R6, PBC, and Opal Loop III pipelines. Permits and/or license agreements for water withdrawal would be obtained from the State of Wyoming. The terms of the permits/agreements would ensure that the quantity used for testing would not harm other uses. Discharge operations would also be permitted by the state, and permit requirements would ensure the discharged water would not damage soils or surface waters at the point of discharge. The test waters would be tested and treated, if necessary, to ensure compliance with federal and state water quality standards and permit conditions prior to release.

4.14.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, an additional 4,485 acres would be disturbed with a LOP disturbance of 1,315 acres. Disturbance would not occur all at once but would increase as development progresses. Sediment loss would be increased by an average of nearly 10 percent over the current conditions under this alternative, without reclamation.

4.14.3.3 Alternative B (Proposed Action Alternative)

The Proposed Action would result in a total disturbance of 6,845 acres, an increase of 53 percent over the No Action Alternative through 2011. LOP disturbance under the Proposed Action would be 2,066 acres, a 57 percent increase over the No Action Alternative in 2011. Sediment loss would be increased by an average of nearly 8 percent in 2011 and 20 percent in 2023 over the current conditions under this alternative, without reclamation.

4.14.3.4 Alternative C

Estimates of initial and LOP disturbance would be similar for Alternative C as for the Proposed Action Alternative. In 2011, although the amount of disturbance would be similar, the distribution of disturbance would be different for Alternative C than it would be for the No Action or for the Proposed Action. By 2023, the patterns of disturbance would be similar for both the Proposed Action Alternative and Alternative C. Sediment loss under this alternative would be similar to that stated above for the Proposed Action Alternative – an average of nearly 8 percent in 2011 and 20 percent in 2023, without reclamation.

4.14.4 Cumulative Impacts

The CIAA for surface water resources is the PAPA which is the same CIAA as for soils and vegetation. Watersheds that drain the PAPA are not expected to be directly impacted outside of the PAPA except for those associated with construction of the gas sales pipelines. The extent of indirect impacts would depend primarily on the effectiveness of erosion control and reclamation within the PAPA. Table 4.14-5 shows the cumulative disturbance impacts for each of the alternatives. The cumulative disturbance for all alternatives includes disturbance associated with non-wellfield disturbance in the PAPA, existing wellfield disturbance in the PAPA and that portion of disturbance associated with the gas sales pipelines that is within the PAPA. Under each of the alternatives, the New Fork River-Alkali Creek sub-watershed would have the most disturbance with nearly 10,000 acres under the Proposed Action Alternative and Alternative C in 2023. Total cumulative disturbance within the PAPA is more than 25,000 acres under each of the alternative in 2023, which represents almost 13 percent of the PAPA.

Table 4.14-5
Cumulative Surface Disturbance in Relation to Sub-Watersheds by Alternative

Sub-Watershed and Hydrologic Unit Code	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Green River-Tyler Draw 140401010403	50.0	21.7	116.7	116.7	116.7	116.8	116.7
Green River-The Mesa 140401010404	23.5	10.1	41.1	41.1	41.1	41.1	41.1
Sand Draw-Alkali Creek 140401010701	5.0	502.2	1,046.1	954.2	971.8	1,603.9	1,804.2
Granite Wash 140401010704	0.8	0.0	8.1	8.1	8.1	8.1	8.1
North Alkali Draw 140401010705	13.0	116.5	377.7	325.4	360.4	458.4	502.5
New Fork River-Duck Creek 140401020102	527.5	92.4	761.0	658.5	658.5	800.9	734.6
Hay Gulch 140401020105	19.1	3.9	23.0	23.0	23.0	23.0	23.0
Lower Pine Creek 140401020203	804.2	3.7	807.9	807.9	807.9	807.9	807.9
New Fork River-Stewart Point 140401020301	2,736.8	361.9	3,290.0	3,306.3	3,306.3	4,033.0	3,977.3
East Fork River 140401020302	23.3	12.0	35.3	35.3	35.3	35.3	35.3
New Fork River-Alkali Creek 140401020303	1,183.7	2,353.6	5,901.3	7,556.7	7,901.0	9,860.0	9,711.3
Sand Springs Draw 140401020304	49.8	81.3	136.3	224.4	233.5	371.5	467.5
New Fork River-Blue Ridge 140401020305	162.6	228.8	549.6	664.3	631.1	946.8	918.6
Mack Reservoir 140401020306	34.3	850.3	1,969.4	2,624.6	2,263.4	3,673.2	3,530.6
Lower Pole Creek 140401020403	1,740.4	0.9	1,741.3	1,741.3	1,741.3	1,741.3	1,741.3
South Muddy Creek 140401020602	20.6	0.0	20.6	20.6	20.6	20.6	20.6
Lower Muddy Creek-New Fork 140401020603	0.0	0.0	7.0	7.0	7.0	7.0	7.0
Big Sandy River-Waterhole Draw 140401040105	1.9	1.5	6.1	3.7	3.7	3.7	3.7
Big Sandy River-Bull Draw 140401040106	22.0	74.2	107.1	130.7	130.7	130.7	130.7
Mud Hole Draw 140401040107	48.4	344.4	491.5	547.8	547.8	547.8	642.2
Long Draw 140401040109	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**

4.14.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to surface water resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).

- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.15 SOIL RESOURCES

4.15.1 Scoping Issues

There were no project scoping comments related to soil resources.

4.15.2 Impacts Considered in the PAPA DEIS

The PAPA DEIS described potential impacts to soils that include:

- increased wind and water erosion;
- loss of topsoil;
- decreased soil and vegetation productivity; and
- introduction and invasion of noxious weeds.

Removal of vegetation and the exposure of soils during construction of well pads, roads and pipelines, along with the alteration and compaction of soils during construction, can increase runoff and wind and water erosion. Topsoil, in particular, is a valuable resource in semi-arid areas such as the PAPA, particularly during reclamation as well as the following considerations:

- topsoil development is slow;
- it provides a crucial plant-growth medium that is essential to establish successful revegetation;
- it is higher in organic matter, fertility and biologic activity than subsoil materials;
- loss or dilution of the topsoil during construction by burial or mixing with subsoil horizons would reduce soil productivity and could hinder successful revegetation; and
- topsoil is generally much darker than subsoil materials and its reapplication during reclamation would help to minimize visual impacts by reducing contrasts on reclaimed sites.

Impacts from erosion would be greatest after initial soil disturbance and would decrease naturally in the short-term due to natural stabilization through particle aggregation and armoring (i.e., formation of soil crusts and pavements). In general, most sediment in the PAPA is from exposed areas (i.e., stream channels and banks, badlands and bare escarpment slopes). The primary factors affecting sediment delivery or movement includes slope gradient, soil particle size, roughness of soil and vegetation cover (see Appendix J - *The Erosion Modeling, Sediment Transport Modeling and Salt Loading Technical Report*).

BLM considered implementation of alternatives in the PAPA DEIS would cause significant impacts to soils if:

- disturbed areas are not adequately stabilized to reduce soil erosion and potential impacts to water quality; or
- there is increased erosion or reduced soil productivity to a level which prevents reestablishment of vegetative cover within 5 years.

Based on these criteria, significant impacts to soils has not been documented. However, as pointed out in Chapter 3 and the sections below, there is considerable surface disturbance in soils that are considered sensitive.

4.15.3 Alternative Impacts

4.15.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

One of the primary concerns related to soil resources is the potential for sedimentation to cause significant adverse impacts to area waters as discussed in Section 4.14. Alteration of soil physical and chemical characteristics (e.g., compaction), dilution of topsoil (i.e., mixing of soil horizons) or the addition of contaminants from spilled materials decrease soil productivity. Sensitive soils (e.g., steep slopes, soils with high erosion potential, saline and/or sodic soils, shallow soils, soils with low reclamation potential or with high water tables) are more susceptible to impacts due to their limiting characteristics. For example, construction activities on steep slopes (greater than 15 percent) would require larger disturbed areas. They would also require longer and steeper cut and fill slopes which are difficult to successfully revegetate and stabilize, and in turn, have a greater erosion potential. These slopes can be difficult to return to their original contour during final reclamation.

By the end of 2006, approximately 590 acres will have been disturbed within the Blue Rim Area of sensitive soils. Some of that disturbance will also be on slopes greater than 15 percent, increasing the likelihood of soil erosion. Implementation of each alternative is expected to increase surface disturbance in both sensitive soils categories by the end of 2011 (Table 4.15-1). The Proposed Action Alternative may disturb less surface area with sensitive soils than the other two alternatives by 2011. Development of the Proposed Action Alternative through 2023 is expected to be similar to Alternative C through 2023 (Table 4.15-1).

Table 4.15-1
Surface Disturbance in Relation to Sensitive Soils SMRZ by Alternative

Sensitive Soils Category	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alterative C 2011	Proposed Action 2023	Alternative C 2023
Blue Rim Area Sensitive Soils	589.9	538.2	978.5	731.4	1,488.4	1,415.6
Soils on slopes ≥ 15%	266.9	179.9	454.3	412.0	753.7	702.9
Sensitive Soils SRMZ[1]	786.9	663.9	1,273.8	1,051.8	2,019.2	1,924.6

[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

Pipeline Corridors and Gas Sales Pipelines

Construction of the proposed pipelines would disturb approximately 2,900 acres. Soil impacts are expected to be temporary (less than 1 year) to short-term (1 to 3 years) in duration. During a period of stabilization and reestablishment of protective vegetative cover, there would be some accelerated erosion and loss of soil material from disturbed areas due to exposure and physical degradation of soil materials during construction activities. Potential for accelerated erosion and soil loss would be greatest in areas with steeper and longer slopes. The largest extent of these steeper and longer slopes is in the Blue Rim Area south of the New Fork River crossing and northwest of the Jonah Field.

Potential for accelerated erosion would be increased during pipeline construction after protective vegetative cover is cleared and topsoil materials are bladed into windrowed stockpiles within the construction rights-of-way. Windrowed topsoil and exposed subsoil would be exposed to accelerated water and wind erosion due to the loss of protective vegetative cover, loss of aggregation, lower infiltration rates, higher runoff rates, and more direct exposure to wind. The exposed subsoils that form the working surface within the construction rights-of-way would also receive rubber-tired and track vehicle traffic which would result in soil compaction. Such compaction could result in reduced soil productivity due to loss of soil structure, increased erodibility, and decreased infiltration and waste storage capacity. Accelerated soil erosion could potentially increase delivery of sediment and salinity to drainages.

Site stabilization and reclamation measures would limit potential impacts to soils in duration, extent, and magnitude. Trench spoil would be backfilled into the trench above the installed pipe and subsoil and topsoil would be redistributed over the construction rights-of-way. Erosion control features would be installed as necessary. Approved seed mix(es) would be applied. All equipment and vehicular access would be confined to existing roads and the established rights-of-way thereby avoiding soil compaction on undisturbed areas. Vehicle travel during saturated soil conditions would be avoided to prevent rutting, to minimize soil compaction, and to reduce potentials for accelerated soil erosion.

4.15.3.2 Alternative A (No Action Alternative)

Continued development in the PAPA under the No Action Alternative through 2011 would likely nearly double the amount of surface disturbances within the Blue Rim Sensitive Soils area and increase surface disturbances by 180 acres within sites on slopes greater or equal to 15 percent (Table 4.15-1). An estimated 660 acres within the Sensitive Soils SRMZ are expected to be affected by development through 2011.

4.15.3.3 Alternative B (Proposed Action Alternative)

<u>Proposed Action Alternative Through 2011</u>

Continued development in the PAPA under the Proposed Action Alternative through 2011 would likely lead to considerably more surface disturbances within the Blue Rim Sensitive Soils area and within sites on slopes greater or equal to 15 percent compared to project disturbance under the No Action Alternative (Table 4.15-1). More than 1,200 acres within the entire Sensitive Soils SRMZ are expected to be affected by developments under the Proposed Action through 2011.

<u>Proposed Action Alternative Through 2023</u>

Under the Proposed Action Alternative through 2023, approximately 2,000 acres would be disturbed in the Sensitive Soils SRMZ. Most of the disturbance (approximately 1,500 acres) would be in sensitive soils within the Blue Rim Area.

4.15.3.4 Alternative C

<u>Alternative C Through 2011</u>

Development in the PAPA under Alternative C through 2011 is expected to more than double the amount of surface disturbances within the Blue Rim Sensitive Soils area and within sites on slopes greater or equal to 15 percent (Table 4.15-1). More than 1,000 acres within the entire Sensitive Soils SRMZ are expected to be affected by developments under Alternative C through 2011.

Alternative C Through 2023

Disturbance to the Sensitive Soils SRMZ and sensitive soils within the Blue Rim Area under Alternative C through 2023 is expected to be similar to the Proposed Action Alternative through 2023.

4.15.4 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to soil resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.15.5 Cumulative Impacts

Cumulative impact analysis to soil resources in the PAPA is based on past, present, and future levels of surface disturbance in Table 4.15-2. There has been only minor disturbance to the Blue Rim sensitive soils and soils on slopes of 15 percent by existing non-wellfield developments. Most of the existing sources were livestock watering facilities and roads. Existing wellfield development in the PAPA has affected sensitive soils by the amounts shown in Table 4.15-2. There would be cumulative impact to sensitive soils by each alternative as well, at least until reclamation has been successfully implemented.

Table 4.15-2
Cumulative Surface Disturbance in Relation to Sensitive Soils SMRZ by Alternative

Sensitive Soils Category	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Blue Rim Area Sensitive Soils	32.8	589.9	918.6	1,358.9	1,111.8	1,868.8	1,796.0
Soils on slopes ≥ 15%	26.7	266.9	813.1	1,087.5	1,045.2	1,386.9	1,336.1
Sensitive Soils SRMZ[1]	55.3	786.9	1,506.1	2,116.0	1,894.0	2,861.4	2,766.8

[1] Areas within Sensitive Soils SRMZ are not the combined total of the Blue Rim Area soils and soils on slopes greater than 15 percent because some soils are in both categories – see Map 3.17-1.

4.16 VEGETATION RESOURCES

4.16.1 Scoping Issues

1. Multiple wells drilled from one well pad should be standard practice to minimize surface disturbance.
2. Operators should coordinate activities with livestock producers who utilize the Mesa.

3. BLM should ensure reclamation is timely, successful, and appropriate to benefit wildlife.

4.16.2 Impacts Considered in the PAPA DEIS

Potential impacts to vegetation from all project alternatives considered in the PAPA DEIS include:

- removal of native vegetation during construction of well pads, roads, and pipelines;
- sagebrush, the predominant shrub within the PAPA, may take 10 to 20 years to become reestablished;
- surface disturbance to sagebrush steppe vegetation may adversely affect wildlife species that depend on sagebrush for some life history function;
- undisturbed ground is covered by microphytic crusts (growths of lichens, algae, mosses, fungi or bacteria on the soil surfaces) which are readily destroyed by vehicles and trampling, thereby increasing erosion potential and suitability for invasions by nonnative species;
- cheatgrass and halogeton are exotic species that have invaded, halogeton is poisonous to livestock; and
- introduction of other noxious weeds following removal of native vegetation is a potential impact that would further limit reestablishment of native species.

BLM considered that impacts to vegetation produced by the alternatives in the DEIS would be significant if:

- within 5 years, reclaimed areas do not attain adequate vegetation cover and species composition to stabilize the site and to support predisturbance land uses including livestock forage, wildlife habitat, and big game population objectives; or
- there is invasion and establishment of noxious nonnative weeds that contribute to unsuccessful revegetation.

It is not know whether vegetation resources have been significantly impacted by existing development in the PAPA, based on the significance criteria, above.

4.16.3 Alternative Impacts

4.16.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

In general, the extent of impacts by removal of vegetation would be influenced by precipitation and soil characteristics. Areas with shallow or exposed subsoils and areas where soils are highly alkaline would be difficult to revegetate. In 1999, mean annual precipitation in the PAPA was approximately 10 inches. Beginning in 2000 and continuing through 2003, precipitation in the PAPA was consistently below the 30-year average. This is in part because snowfall (October through April) was below the 30-year average of 58 inches since 1987, except during winter 2003-2004 (see Table 3.3-1). With the possibility that drought could continue, the future of successful revegetation in the PAPA could be at risk.

Wellfield development directly impacts vegetation, primarily by its removal. Indirect impact to vegetation may occur if wellfield development displaces native and domestic herbivores, causing excessive browsing and/or grazing on vegetation resources that would otherwise not occur. Indirect impact to native vegetation can also occur if invasive non-native species become established and limit or prohibit growth of native species. Sagebrush-dominated vegetation is the most extensive of all vegetation categories in the PAPA. By the end of 2006, most surface disturbance is projected to occur in the sagebrush steppe vegetation type, nearly 3,900 acres (Table 4.16-1). Continued direct impact to sagebrush and other native vegetation types is expected under each alternative. The potential for significant impact would increase as additional development is implemented under any of the alternatives.

While black henbane and scentless chamomile have been declared as noxious weeds by Sublette County, large areas of the county have been infiltrated by Canada thistle and perennial pepperweed and to lesser extents by hoary cress and Russian knapweed. Because noxious weeds are often able to establish in areas following surface disturbance, primarily along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2005d), the potential for increased infestation and profusion of weeds is very likely under all of the alternatives.

Table 4.16-1
Surface Disturbance in Relation to Vegetation Types by Alternative

Vegetation Category	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Sagebrush Steppe	3,864.1	3,313.6	4,874.3	4,986.9	8,865.2	9,112.9
Mixed Grass Prairie	409.1	380.6	760.6	646.5	1,126.1	1,001.0
Greasewood Flats	46.9	84.2	79.3	71.2	234.7	226.0
Desert Shrub	286.5	261.3	596.1	453.1	938.0	978.7
Riparian Forest and Shrub	70.4	74.7	58.9	84.8	278.0	269.3
Other limited types	3.6	1.4	1.4	1.4	9.1	6.8
Barren Ground	45.8	37.8	87.6	66.8	109.8	88.5
Irrigated Cropland	310.9	329.1	386.8	545.9	717.5	588.4
Human Settlement	22.1	1.8	0.0	0.0	0.0	0.0
Total	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**

Pipeline Corridors and Gas Sales Pipelines

Construction of pipelines within the proposed corridors would directly impact and possibly indirectly impact vegetation by the mechanisms discussed, above. The extent of active disturbance to the vegetative cover is expected to be limited to the construction rights-of-way approved for each pipeline. Incremental disturbance and subsequent reclamation of the corridors is anticipated with each pipeline installation.

Construction of the proposed R6 and the PBC and Opal Loop III pipelines would disturb approximately 2,813 acres of mostly native shrubs and grasses. Construction activities would result in either the direct removal of vegetation by blading, excavation/trenching or damage from vehicular traffic and placement of equipment and materials where some vegetation may be left in place within the rights-of-way. Removed vegetative debris would be windrowed to one side of the construction rights-of-way, usually in combination with salvaged topsoil materials, for later redistribution across the disturbed rights-of-way as part of reclamation.

Invasive, noxious weed species could establish in cleared, disturbed areas resulting in infestations that may limit success of native and/or desirable species. Weed seeds or cuttings of some species could be transported naturally or accidentally to the disturbed areas. Weed seeds may be present in the native soil materials and the removal of vegetative cover and soil disturbance may promote weed establishment at the expense of desirable species.

To replace protective cover, to limit weed infestation, and to restore vegetative productivity of desirable species, all areas disturbed for pipeline construction would be reclaimed and revegetated after construction is complete. Revegetation would be conducted with landowner approved seed mixtures to promote establishment of grasses in the short-term while the shrubs would become established over a longer period of time. On federal lands, different seed mixtures may be applied to different areas at the direction of the BLM/BOR. Grasses could require 2 to 3 years for successful re-establishment in arid environments. Shrub components may require more than 20 years for recovery to predisturbance levels after reseeding and reclamation. Although some weed infestation may be anticipated on the pipeline construction rights-of-ways, the application of weed control measures would minimize impacts from weed species. Overall, long-term impacts to vegetative resources should be minimal.

4.16.3.2 Alternative A (No Action Alternative)

Under the No Action Alternative, more than 3,300 acres of sagebrush steppe vegetation would be disturbed with over 4,000 acres disturbed overall.

4.16.3.3 Alternative B (Proposed Action Alternative)

<u>Proposed Action Alternative Through 2011</u>

Implementation of the Proposed Action would result in removal of almost 5,000 acres of sagebrush steppe vegetation through 2011 (Table 4.16-1). In almost all vegetation types, particularly mixed grass prairie and desert shrub, disturbance would exceed disturbance in those types by the No Action Alternative.

<u>Proposed Action Alternative Through 2023</u>

Through 2023, the Proposed Action Alternative would remove almost 9,000 acres of sagebrush steppe vegetation (Table 4.16-1). Most other disturbance would be in the Mixed Grass Prairie and Desert Shrub vegetation types.

4.16.3.4 Alternative C

<u>Alternative C Through 2011</u>

Implementation of Alternative C could result in long-term removal of nearly 5,000 acres of sagebrush steppe in 2011 (Table 4.16-1), approximately the same amount as projected for the Proposed Action Alternative. Effects to some other vegetation types, particularly irrigated cropland, mixed grass prairie and desert shrub, would likely exceed disturbance in those types by the No Action Alternative though in other vegetation categories, disturbances would probably be almost equivalent by the end of 2011.

<u>Alternative C Through 2023</u>

By 2023, Alternative C is expected to increase existing surface disturbances by about 9,000 acres within sagebrush steppe, which is similar to the disturbance under the Proposed Action Alternative through 2023.

Under Alternative C, because development would be complete in the southern area of DA-1 before moving north and development in DA-2 would be complete before moving to DA-3, the potential exists for focal points of final reclamation rather than just interim reclamation. Under Alternative C, final reclamation must begin, once an area is fully developed. Depending on how successful future revegetation efforts would be during the 17-year period of wellfield development, there may be some reestablishment of native vegetation within the PAPA, though not to pre-disturbance levels. Disturbed areas within sagebrush steppe would most likely be converted to some other vegetation type.

4.16.4 Cumulative Impacts

The CIAA for vegetation is the PAPA. Cumulative impact analysis to vegetation resources in the PAPA is based on past, present, and future levels of surface disturbances in Table 4.16-2 for which the vast majority of impact is and would be within sagebrush steppe. There would be cumulative impact to irrigated cropland by each alternative as well. Over 5,000 acres of irrigated cropland is due to agricultural use. Even so, there is existing wellfield development (311 acres) and future development that would convert cropland to a non-vegetated status, at least until reclamation has been successfully implemented. Likewise, the human settlement category in Table 4.16-2 is composed of residences, roads, and urban infrastructure in the PAPA.

Table 4.16-2
Cumulative Surface Disturbance to Vegetation Types by Alternative

Vegetation Category	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Sagebrush Steppe	963.5	3,864.1	8,435.3	9,996.0	10,108.6	13,986.9	14,234.6
Mixed Grass Prairie	35.3	409.1	859.4	1,239.4	1,125.3	1,604.9	1,479.8
Greasewood Flats	18.2	46.9	149.3	144.4	136.3	299.8	291.1
Desert Shrub	27.4	286.5	639.5	974.3	831.3	1,316.2	1,356.9
Riparian Forest and Shrub	31.9	70.4	184.3	168.5	194.4	387.6	378.9
Other limited types	0.0	3.6	5.0	5.0	5.0	12.7	10.4
Barren Ground	3.6	45.8	87.4	137.2	116.4	159.4	138.1
Irrigated Cropland	5,688.4	310.9	6,354.4	6,412.1	6,571.2	6,742.8	6,613.7
Human Settlement	698.6	22.1	722.5	720.7	720.7	720.7	720.7
Total	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**

While existing, non-wellfield disturbance has generated a minor amount of disturbance compared to existing and future wellfield disturbance, the majority of existing wellfield disturbance has been concentrated in sagebrush steppe and future disturbances by any alternative are expected in sagebrush steppe as well. Compared to the No Action Alternative, there would be far more cumulative impact by the Proposed Action Alternative and Alternative C to sagebrush steppe through 2011 and certainly by 2023 (Table 4.16-2). The same is true, though not to the same level, for cumulative effects to other vegetation in the PAPA by the alternatives.

4.16.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to vegetation resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.17 GRAZING RESOURCES

4.17.1 Scoping Issues

The following concerns related to livestock and grazing resources were raised during the scoping process:

1. BLM should evaluate how effects to wintering mule deer on the Mesa would affect private lands and consider off-site mitigation for affected landowners.
2. BLM should evaluate how offsite mitigation benefiting wildlife would reduce livestock AUMs on and off the Mesa.
3. Operators should coordinate activities with livestock producers who utilize the Mesa.

4.17.2 Impacts Considered in the PAPA DEIS

BLM analyzed potential impact to grazing resources from wellfield development in the PAPA DEIS (BLM, 1999a). BLM considered the primary impact to grazing resources would be the loss of forage associated with construction and production related disturbance. Loss of forage associated with construction was anticipated to be temporary (short-term), lasting until areas became revegetated, approximately 3 to 5 years after reclamation. However, production related disturbance, such as portions of well pads and road surfaces, would convert rangeland to an industrial use for the life of the project. Other impacts to grazing considered in the PAPA DEIS include:

- displacement of livestock from preferred grazing areas and stock watering facilities or ponds;
- disruption of livestock trailing by surface pipelines (typically greater than 6 inches in diameter), and new roads that run perpendicular to cattle drive trails, or large surface pipelines laid across two-track roads which impede vehicles and cause annoying and sometimes long detours;
- damage to range improvements including fences, cattleguards, water wells, and water impoundments;
- the spread of noxious weeds; and
- increased injury or loss of livestock from vehicle-livestock collisions or other incidents associated with oil and gas operations.

Section 4.13 describes the potential impacts of water supply wells in the PAPA could have on the existing stock water wells. BLM considered impacts produced by the project alternatives would be significant if:

- animal unit months (AUM) in any single grazing allotment declined by 5 percent or more through clearing or disturbance of vegetation; or
- project activities result in long-term disruption of grazing management, such as changes in livestock use patterns, which result in increased resource conflicts or changes in ranching operations, livestock trailing, watering, fencing, and feeding.

More than 5 percent of some grazing allotments in the PAPA have been subject to surface disturbance as of 2006. Assuming that grazing capacities (AUMs) in any allotment are directly related to the amount of vegetation present, those allotments have been significantly impacted by current wellfield developments, under the significance criteria in the PAPA DEIS (BLM, 1999a).

4.17.3 Alternative Impacts

4.17.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Wellfield development directly impacts grazing resources, primarily by removal of vegetation. Indirect impact to grazing resources may occur if wellfield development displaces native herbivores and livestock, causing them to graze unaffected areas. Displacement and concentration of animals could cause excessive grazing pressure on vegetation that would otherwise not occur. Indirect impact to native vegetation, and consequently grazing, can also occur if invasive nonnative species become established and limit or prohibit growth of native vegetation. Nonnative invasive species may be less palatable than native vegetation and some may be toxic to livestock.

Of the 16 grazing allotments in the PAPA, the ones most affected by wellfield development and those that would continue to be affected are on the Anticline Crest. The amount of surface disturbance that has been reclaimed in allotments is unknown and there is no evaluation of successful revegetation that could offset the impact to AUMs by surface disturbance.

Though no estimate has been made of changes in AUMs within either allotment, the amount of surface disturbance suggests that significant impacts to grazing resources (more than 5 percent of the total allotment areas) in two allotments have already occurred according to the impact significance criteria established in the PAPA DEIS (BLM, 1999a). The amount of forage lost to livestock grazing within any single allotment during future development by any of the alternatives cannot be predicted since because revegetation of disturbed surfaces would compensate for forage lost through development. Future wellfield development under any alternative is expected to generate significant impact according to the significance criteria in the PAPA DEIS (Table 4.17-1). Such impacts are expected to be reduced to levels below impact significance once surface disturbance has been fully reclaimed.

Black henbane and scentless chamomile are declared weeds in Sublette County. Relatively large areas of the county have been infiltrated by Canada thistle and perennial pepperweed and to lesser extents by hoary cress and Russian knapweed. Noxious weeds are often able to establish in areas following surface disturbance, primarily along roads, areas of oil and gas development, and in heavily grazed areas (BLM, 2005d), and therefore, the potential for increased infestation and profusion of weeds is very likely under any of the alternatives. Canada thistle and perennial pepper weed are especially aggressive and difficult to control once established. Hoary cress can be controlled with herbicides but is very competitive with other plants if established and Russian knapweed readily colonizes pastures, roadsides and other disturbed sites.

Table 4.17-1
Surface Disturbance in Relation to Grazing Allotments by Alternative

Allotment and Number	Estimated Existing Wellfield (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Blue Rim Individual (2173)	1,401.9	1,582.8	2,182.1	2,196.9	4,335.1	4,742.6
Circle 9 Individual (2124)	0.0	0.0	0.0	0.0	0.0	0.0
Clark-Bloom Common (2053)	40.0	117.6	25.6	25.6	149.2	91.6
Blue Rim Desert (2029)	15.5	0.0	1.7	1.7	1.7	1.7
Fremont Butte Common (2009)	81.4	2.9	79.1	79.1	248.1	284.2
Luman Individual (2124)	11.4	0.0	8.9	8.9	9.6	8.9
Marincic Mesa Individual (2132)	0.2	0.0	0.0	0.0	0.0	0.0
Mesa Common (2031)	1,425.4	1,086.1	2,748.2	2,637.9	3,378.3	2,970.2
Mount Airy Common (2049)	378.7	343.4	346.2	336.5	1,194.8	1,207.7
New Fork Individual (2113)	320.8	371.4	312.2	241.9	696.1	753.2
Burch (2050)	7.9	0.0	20.6	20.8	80.0	31.6
Northwest Square Top Individual (2123)	122.6	200.9	154.8	156.9	521.2	517.3
Square Top Common (2051)	62.1	18.3	14.9	14.9	14.9	15.5
Stud Horse Common (2008)	508.0	266.2	351.6	351.6	396.8	555.8
Boundary/Poston (13005)	54.2	0.0	2.2	2.2	2.2	2.2
Sand Draw (2156)	0.0	0.0	0.0	0.0	0.0	0.0
Total	**4,430.1**	**3,989.6**	**6,248.1**	**6,074.9**	**11,028.0**	**11,182.5**

<u>Pipeline Corridors and Gas Sales Pipelines</u>

Establishment of the three proposed pipeline corridors would have no immediate impact on lands within those portions of the corridors used for livestock grazing. However, pipeline construction within the proposed corridors would result in short-term loss of available forage and potential temporary impacts on animal movement and well-being.

Based on an average stocking ratio of 11.5 acres per AUM for the area (BLM, 2006a), the construction of the proposed pipelines would affect 252 AUMs (2,900 acres/11.5 acres per AUM). That estimate includes federal, state, and private lands and assumes all lands within the corridors are open to grazing. These affected AUMs would be restored in the short-term as re-seeded vegetation reestablishes and restores vegetative productivity in the construction rights-of-ways over a 1 to 3 year period.

To minimize impacts to animal movement and overall well being, soft plugs would be constructed and left in the open trenchline every 0.25 mile to allow for livestock and wildlife crossings and if necessary escape from the trench should an animal fall into the open trench.

Long-term loss of forage would be negligible because of the minimal amount of life of project disturbance (less than 1 acre for each pipeline) required for ancillary surface facilities.

4.17.3.2 Alternative A (No Action Alternative)

Assuming that revegetation on surfaces disturbed by wellfield development would not have reestablished livestock grazing capacities within affected allotments by 2011, significant impacts (using BLM's criteria in the PAPA DEIS) would occur within the Blue Rim Individual, Mesa Common, and Northwest Square Top Individual allotments by 2011. In these allotments, the amount of grazing capacity affected would be more than 5 percent of the total allotment.

Continued wellfield development though 2011 under the No Action Alternative would further impact grazing resources on the New Fork Individual and Stud Horse Common allotments. The No Action Alternative is likely to affect the New Fork Individual allotment more than the other two alternatives by 2011 (Table 4.17-1).

4.17.3.3 Alternative B (Proposed Action Alternative)

<u>Proposed Action Alternative Through 2011</u>

Significant impact to grazing capacities within several allotments is expected under the Proposed Action Alternative through 2011. More surface disturbance than would have been generated under the No Action Alternative is likely in the New Fork Individual and Stud Horse Common allotments in 2011, but those had already been significantly impacted by 2006 according to BLM's impact significance criteria in the PAPA DEIS (see Section 4.17.3). More surface disturbance is expected in the Blue Rim Individual and Mesa Common allotments by 2011 than by the No Action Alternative. More than 5 percent of the grazing capacity (AUMs) is likely to be lost in these two allotments by 2011, assuming direct relationship between surface disturbance to vegetation and AUMs.

<u>Proposed Action Alternative Through 2023</u>

By the end of 2023, the Proposed Action Alternative potentially would have generated more than 11,000 acres of new disturbance within all grazing allotments in the PAPA, combined. Depending on how successful future revegetation efforts would be during the 17-year period of wellfield development, grazing capacity may or may not become reestablished to levels below 5 percent in allotments where substantial areas have been disturbed. Many existing well pads and pipeline corridors are likely to be re-disturbed in the future during well pad expansions and construction of new gathering pipelines, potentially within existing corridors.

4.17.3.4 Alternative C

<u>Alternative C Through 2011</u>

Similar to the Proposed Action Alternative, significant impact to grazing capacities within several allotments is expected under Alternative C through 2011. Less surface disturbance than would have been generated under the No Action Alternative would be likely in the New Fork Individual allotment but more disturbance would be likely in Stud Horse Common allotment in 2011. More surface disturbance is expected in the Blue Rim Individual and Mesa Common allotments by 2011 than by the No Action Alternative. More than 5 percent of the grazing capacity is likely to be affected in these two allotments by 2011.

<u>Alternative C Through 2023</u>

By the end of 2023, Alternative C would have disturbed more than 11,000 acres within all gazing allotments in the PAPA, combined. This is similar to the amount of surface disturbance that would be generated by the Proposed Action Alternative.

With wellfield development completed in specific areas before new areas would be developed, the potential for focal points of final reclamation rather than interim reclamation is possible under

Alternative C. That possibility does not exist under the Proposed Action Alternative. Depending on how successful future revegetation efforts would be during the 17-year period of wellfield development, grazing capacity may or may not become reestablished to levels below 5 percent in allotments where substantial areas have been disturbed.

4.17.4 Cumulative Impacts

The CIAA for grazing resources is the PAPA. Even though employment in agriculture within Sublette County decreased from 2001 to 2004 (see Section 3.5), livestock grazing in the PAPA remains an important use of lands within BLM grazing allotments by livestock producers (see scoping comments in Section 4.17-1, above). Cumulative impact analysis to grazing resources in the PAPA is based on past, present, and future levels of surface disturbances in Table 4.17-2.

Table 4.17-2
Cumulative Surface Disturbance in Relation to Grazing Allotments by Alternative

Allotment and Number	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Blue Rim Individual (2173)	44.7	1,401.9	3,348.4	3,947.7	3,962.5	6,100.7	6,508.2
Circle 9 Individual (2124)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clark-Bloom Common (2053)	104.1	40.0	261.7	169.7	169.7	293.3	235.7
Blue Rim Desert (2029)	55.3	15.5	70.8	72.5	72.5	72.5	72.5
Fremont Butte Common (2009)	0.0	81.4	84.3	160.5	160.5	329.5	365.6
Luman Individual (2124)	18.5	11.4	29.9	38.8	38.8	39.5	38.8
Marincic Mesa Individual (2132)	0.0	0.2	0.2	0.2	0.2	0.2	0.2
Mesa Common (2031)	143.5	1,425.4	2,664.6	4,326.7	4,216.4	4,956.8	4,548.7
Mount Airy Common (2049)	1.5	378.7	723.6	726.4	716.7	1,575.0	1,587.9
New Fork Individual (2113)	0.0	320.8	741.2	682.0	611.7	1,065.9	1,123.0
Burch (2050)	5.2	7.9	13.1	33.7	33.9	93.1	44.7
Northwest Square Top Individual (2123)	6.3	122.6	329.8	283.7	285.8	650.1	646.2
Square Top Common (2051)	22.6	62.1	103.0	99.6	99.6	99.6	100.2
Stud Horse Common (2008)	18.5	508.0	792.7	878.1	878.1	923.3	1,082.3
Boundary/Poston (13005)	25.4	54.2	79.6	81.8	81.8	81.8	81.8
Sand Draw (2156)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**445.6**	**4,430.1**	**9,242.9**	**11,501.4**	**11,328.2**	**16,281.3**	**16,435.8**

Existing, non-wellfield disturbance has generated a minor amount of disturbance in grazing allotments in the PAPA. Since 2000, wellfield disturbance is about ten 10 times the area (4,430 acres) that had been disturbed by non-wellfield actions (446 acres). Compared to the No Action Alternative, there would be far more cumulative impact by the Proposed Action Alternative and Alternative C to grazing allotments through 2011 (Table 4.17-2).

By 2023, cumulative disturbance under the Proposed Action Alternative and Alternative C would be approximately 10 percent of all grazing lands in the PAPA, but that cumulative effect would not be distributed among all allotments. Focal areas of cumulative disturbance in 2023 would be in the New Fork Individual allotment with 43 percent of the total land within the PAPA disturbed, the Mount Airy Common (17 percent disturbed in the PAPA), Blue Rim Individual (16 percent disturbed in the PAPA), the Stud Horse Common (9 percent disturbed), and Mesa Common allotment (9 percent disturbed).

4.17.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to grazing resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.18 WETLANDS, RIPARIAN RESOURCES AND FLOOD PLAINS

4.18.1 Scoping

There were no comments related to wetlands, riparian resources or flood plains from project scoping.

4.18.2 Impacts Considered in the PAPA DEIS

Jurisdictional wetlands considered in the PAPA DEIS (BLM, 1999a), and continue to be, primarily associated with the Green River and New Fork River flood plains that support wet meadow, aquatic bed, riparian scrub shrub, and riverine wetland types. Stock ponds fall within another wetland category. To minimize impact to wetlands, BLM considered the following actions:

- locations of new well pads would be avoided within 500 feet of perennial streams, riparian areas, or wetlands on federal lands and minerals (96 percent of all wetlands in the PAPA are located on private and state lands and minerals);
- avoid placement of well pads within 100-year flood plains; and
- some impacts to intermittent streams by road and pipeline crossings would be unavoidable.

By adhering to conditions in permits issued by COE for pipeline and road construction, no significant impacts to those "waters of the U.S" were expected. Section 404 of the Clean Water Act requires that a permit be issued to insure that no discharge of dredged material or fill material is allowed to enter waters of the U.S. if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. To obtain a Section 404 permit from COE, the applicant must demonstrate that three steps have been accomplished: wetland impacts have been avoided, where practicable; potential impacts to wetlands have been minimized; and, compensation has been provided for any remaining unavoidable impacts through activities to restore or create wetlands.

In the PAPA DEIS, BLM determined that impacts by the project alternatives would be significant if:

- there is a loss of wetlands or wetland function in the project area; or
- there is any violation of the requirements for Section 404 permits.

BLM concluded that significant impacts to wetlands would likely occur from implementation of the alternatives considered in the PAPA DEIS (BLM, 1999a) by the following:

- loss of wetlands or wetland function could occur from authorization under general permits without mitigation as a requirement; and
- although the COE usually requires restoration or creation of similar wetland types as mitigation for projects that impact more than 0.33 acre of wetland, it takes several years for a wetland created as mitigation to develop functions that are typical of natural wetlands, especially scrub-shrub and forested wetlands.

Therefore, the loss of wetlands without mitigation would be significant long-term impacts and when mitigation is required, there would be significant short-term impacts due to the temporary loss of important wetland functions. It is not known if wetlands (including riparian zones and flood plains) have been significantly impacted (based on the significance criteria, above) by existing development within the PAPA.

4.18.3 Alternative Impacts

4.18.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Wellfield disturbance has occurred within wetlands, within the Wetland SRMZ, and the 100-year flood plain of the New Fork River. Direct impacts to those resources were described in Chapter 3 and are summarized in Table 4.18-1. Continued development in the PAPA by the alternatives would disturb additional acreages within wetlands, riparian zones, and 100-year flood plains. Most, if not all disturbance to wetlands, the riparian zone of the New Fork River, and the 100-year flood plain has been and would continue to be on nonfederal lands and minerals. Consequently, BLM does not have an inventory of wellfield development effects to specific wetlands or other features. It is not known if Operators have been issued specific COE Section 404 permits. All existing and future surface disturbance to wetlands is potentially unmitigated, and if so, would be judged to be significant impacts to wetlands, riparian zones and 100-year flood plains under the significance criteria in the PAPA DEIS.

Ninety-six percent of wetlands in the PAPA occur on private and state lands and minerals, and therefore, past efforts to avoid disturbance within wetlands are unknown. Future disturbance within wetlands and the 100-year flood plain should be subject to COE Section 404 permit conditions. The amounts of additional surface disturbances shown in Table 4.18-1 do not take into account any efforts to avoid impact to wetlands as consequences of Section 404 permits issued by COE. The potential for significant impact would increase as additional development is implemented under any of the alternatives, according to the significance criteria in the PAPA DEIS (BLM, 1999a).

Table 4.18-1
Surface Disturbance in Relation to Wetlands, the Wetland SRMZ, and Flood Plain SRMZ by Alternative

Sensitive Resource	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Wetlands	149.7	167.5	184.4	222.6	466.7	430.7
Wetland SRMZ	275.1	227.9	357.5	378.2	740.9	692.6
100-Year Flood Plain and Flood Plain SRMZ	182.0	197.5	246.7	297.3	612.4	589.5

Pipeline Corridors and Gas Sales Pipelines

Potential impacts to wetlands may occur as a result of pipeline construction within the proposed pipeline corridor system. These impacts would likely occur as a result of ground disturbance within the proposed BCC pipeline corridors and at the crossings of the New Fork River flood plain by the R6 and PBC pipelines. Impacts to the river, wetlands within the flood plain, and riparian habitats would be minimized by the use of HDD construction technique at river crossings. However, due to spatial requirements of HDD temporary use areas, minor short-term impacts to wetlands within the flood plain may occur. Construction techniques within wetlands would include segregation of hydric topsoil from spoil during construction. Reclamation is expected to be successful due replacement of hydric soils, the existing moisture regime, and the anaerobic conditions that are favorable to hydrophytic vegetation. Seed sources for wetland species are likely present within and adjacent to the proposed rights-of-way and existing plant material and seeds in the soil would likely contribute to successful revegetation of disturbed areas within 1 to 3 years.

Wetland vegetation is only present along the riverbanks, immediately adjacent to the Green and Blacks Fork rivers. These areas consist of small strips of hydrophytic vegetation present only at the waters edge. Due to the use of HDD crossing techniques, these limited wetland areas would not be disturbed by pipeline construction. No other wetlands are present within the proposed pipeline corridors.

4.18.3.2 Alternative A (No Action Alternative)

The No Action Alternative is expected to increase surface disturbance within wetlands and within the 100-year flood plain by 2011. Included within the 228 acres affected by the No Action Alternative in the Wetland SRMZ (Table 4.18-1) are 75 acres of disturbance to riparian forest and riparian shrub vegetation (see Table 4. 16-1).

4.18.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

The Proposed Action Alternative through 2011 is expected to further increase surface disturbances within wetlands and the 100-year flood plain than under the No Action Alternative. Included within the 358 acres affected by the Proposed Action Alternative in the Wetland SRMZ (Table 4.18-1) are 59 acres of disturbance to riparian forest and riparian shrub vegetation (see Table 4. 16-1).

Proposed Action Alternative Through 2023

By 2023, the Proposed Action Alternative would disturb more than 700 acres within the Wetland SRMZ (Table 4.18-1). Included within that disturbance would be 278 acres of riparian forest and shrub vegetation (Table 4.16-1).

4.18.3.4 Alternative C

Alternative C Through 2011

Wellfield developments through 2011 would be focused within DA-2 under Alternative C. Therefore, more surface disturbance within wetlands and within the 100-year flood plain north of the New Fork River are expected through 2011 than by disturbances generated under the No Action and Proposed Action alternatives (Table 4.18-1). Alternative C through 2011 would affect 85 acres of riparian forest and shrub vegetation (Table 4.16-1) which is included in the 378 acres affected in the Wetland SRMZ.

Alternative C Through 2023

By 2023, disturbance to wetlands and within the 100-year flood plain under Alternative C would be similar to the Proposed Action Alternative. Included within the estimate of more than 690 acres affected within the Wetland SRMZ by Alternative C are 269 acres of riparian forest and shrub vegetation (Table 4.16-1).

4.18.4 Cumulative Impacts

Cumulative impact analysis to wetlands, the Wetland SRMZ, and Flood Plain SRMZ in the PAPA (the CIAA) is based on past, present, and future levels of surface disturbances in Table 4.18-2. Existing non-wellfield disturbance in wetlands and the Wetland SRMZ appears substantial but is mainly due to irrigated and non-irrigated croplands in those areas of the PAPA while only minor non-wellfield disturbance has occurred in the 100-year flood plain, primarily from roads and residences. By 2006, disturbances to each of the three areas by existing wellfield development are relatively minor.

Implementation of any of the three alternatives would generate considerable cumulative disturbances to wetlands, the Wetland SRMZ, and Flood Plain SRMZ as shown in Table 4.18-2. Through 2011, each of the three alternatives would cumulatively affect somewhat similar areas though slightly more overall by Alternative C. Compared to the No Action Alternative however, there would be far more cumulative impact by the Proposed Action Alternative and Alternative C to wetlands, the Wetland SRMZ, and Flood Plain SRMZ by 2023 (Table 4.18-2).

Table 4.18-2
Cumulative Surface Disturbance in Relation to Wetlands, the Wetland SRMZ, and Flood Plain SRMZ by Alternative

Sensitive Resource	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Wetlands	1,631.0	149.7	1,965.6	1,982.5	2,020.7	2,264.8	2,228.8
Wetland SRMZ	2,444.7	275.1	2,968.5	3,098.1	3,118.8	3,481.5	3,433.2
100-Year Flood Plain and Flood Plain SRMZ	46.3	182.0	444.7	493.9	544.5	859.6	836.7

4.18.5 Alternative Impact Analysis

Potential measures appropriate to mitigate impact to wetland, riparian resources and flood plains would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.19 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

4.19.1 Scoping

There were no comments received during project scoping related to threatened and endangered species or special status species.

4.19.2 Impacts Considered in the PAPA DEIS

Section 7(a) of the ESA requires BLM to ensure that actions which they authorize or permit are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat for such species. Such action could result in "take" of a listed species. As defined in the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. §1532(19)). This broad definition includes "harm," a term subject to debate. FWS defined "harm" as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 C.F.R. § 17.3 (1994)), an interpretation that has been upheld by the U.S. Supreme Court. Even though an action may "harm" a listed species, the ESA, as amended, recognizes that incidental take (50 C.F.R. § 402.02) can occur in "carrying out an otherwise lawful activity conducted by the federal agency or applicant."

Following the definitions of "take" and "harm," the PAPA DEIS (BLM, 1999a) examined impacts to federally listed endangered or threatened species by potential development in the PAPA. Impacts were considered and evaluated if a species potentially occurred near the PAPA or if any of the criteria listed below were met:

- direct mortality of individuals (fish, wildlife, or plants);
- long-term or permanent loss or alteration of existing or potential fish or wildlife habitat supporting significant life history functions (e.g., breeding, wintering, or migration); or
- temporary alteration or disturbance of habitat that may result in avoidance by listed fish or wildlife species, and increased mortality or lowered reproductive success.

BLM (2002) updated their *Sensitive Species Policy and List* in Wyoming in 2002 with the following stated goals:

- maintain vulnerable species and habitat components in functional BLM ecosystems;

- ensure sensitive species are considered in land management decisions;
- prevent a need for species listing under the Endangered Species Act; and
- prioritize needed conservation work with an emphasis on habitat.

In the PAPA DEIS (BLM, 1999a), BLM declared that impacts to federally listed threatened and endangered species, species proposed for listing, candidate species, and species with special status recognized by FWS, BLM, and WGFD would be considered significant if any of the following occurs:

- the death of any individuals due to project related activities, which would jeopardize the continued existence of a species;
- reduced recruitment and/or survival of individuals that would impede species' recovery;
- loss of federally designated critical habitats; or
- contributing causes to warrant an unlisted species to be proposed for listing as threatened or endangered under the Endangered Species Act (ESA).

The PAPA DEIS (BLM, 1999a) determined that implementation of any of the alternative development scenarios would not be likely to adversely affect species listed under the ESA. The FWS concurred with that determination in their Biological Opinion (see Appendix F in the PAPA ROD).

4.19.3 Alternative Impacts

4.19.3.1 Summary of Impacts Common to All Alternatives

<u>Natural Gas Development within the PAPA</u>

Federally Listed Species. The only species listed under the ESA that has been documented within the PAPA is the bald eagle, listed as threatened. In addition to protection under ESA, bald eagles are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Incidental take of bald eagles, whether from direct or indirect impact, could occur under any of the alternatives.

Other species listed under ESA considered in this document include the black-footed ferret (endangered), Kendall Warm Springs dace (endangered), grizzly bear (threatened), Canada lynx (threatened), Ute ladies'-tresses orchid (threatened), and gray wolf (experimental population). Incidental take is not expected for any of the other federally listed species, by any of the alternatives.

<u>Bald Eagle</u>. Bald eagles nest in the PAPA and feed on fish, waterfowl, and big game carrion. They inhabit forest-dominated riparian zones along the Green and New Fork rivers for perching during the breeding season and during winter. Most of the existing surface disturbance, in forested-dominated riparian vegetation, is on private land. Bald eagle nests in the PAPA are also on private land.

FWS could consider wellfield disturbances on private lands within the PAPA as interrelated and interdependent to disturbances authorized by BLM on federal lands and minerals under the ESA. Wellfield development on private lands may require access roads and pipelines across federally managed lands that have been authorized by BLM. To address potential conflicts between wellfield developments on private lands and bald eagles, Ultra, Shell, Questar, and JGGC consulted with FWS for conservation approaches to minimize impact to bald eagle habitats along the New Fork River. The FWS recommended BMPs on private lands that are to be used voluntarily by the Operators, with technical assistance from BLM. The BMPs apply to other raptor species as well as bald eagles and were designed to minimize adverse effects during development. The FWS recommended the following spatial and timing constraints:

- avoid activities within 1 mile of active bald eagle nests from courtship (February 1) through fledging (August 15);
- avoid activities within 1 mile of roosts used during winter, November 1 through April 1; and
- strive to conserve potential nesting, roosting, and foraging habitats of mature and old growth trees, particularly within 0.5 mile of water.

Ultra, Shell, Questar, and JGGC proposed several measures to minimize disturbance to bald eagles when development would be within the spatial buffers during periods when habitats may be used by bald eagles. Those measures include:

1. *"During night operations and only when worker's safety is not reduced, direct lighting toward the pad to avoid light disturbances to surrounding areas;*
2. *Reduce unnecessary traffic and encourage travel times to be during daylight hours between 9 a.m. and 3 p.m.;*
3. *In areas within 1 mile of active nests where there is line of sight from active nests to the activity, pipeline installation equipment shall be shielded from the affected area with camouflage netting; and*
4. *Avoid potentially disruptive activities or permanent aboveground structures in the bald eagles' direct flight path between their nest and roost sites and important foraging areas."*

With these measures, FWS cautioned that they would not support activities within recommended protective buffers. This could result in adverse effects to bald eagles and/or other raptors. Application of any of the above measures within protective buffers should be used with caution. "Take" could occur and would be a violation of the ESA, Section 9, and other legislation protecting bald eagles.

BLM uses the spatial and temporal buffers recommended by FWS as standard practices. BLM considers activities within 1 mile of forested-dominated riparian vegetation as potentially disruptive to bald eagle use of those habitats during winter. Surface disturbance within 1 mile of the New Fork River riparian zone would occur under each of the alternatives by 2011, but minimal new surface disturbances are likely within 1 mile of existing nest sites (Table 4.19-1). Implementation of the Proposed Action Alternative and Alternative C would likely increase disturbances within the 1-mile nest site buffer and certainly increase surface disturbances within 1 mile of riparian zones by 2023.

Table 4.19-1
Surface Disturbance in Relation to 1-Mile Buffer of Bald Eagle Habitats by Alternative

Bald Eagle Habitat Component	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
1 mile of Active Bald Eagle Nests	48.7	1.5	2.3	2.3	39.7	10.8
1 mile of New Fork River Riparian Zone	828.1	740.1	862.3	984.5	2,083.1	1,833.3
Forest-Dominated Riparian Vegetation	64.9	74.7	59.0	84.9	278.1	269.4

Bald eagles may have established communal winter roosts within forest-dominated riparian vegetation in or near the PAPA, although locations of communal roosts have not yet been firmly established. Depending on their locations, wellfield development during winter could be within the 1-mile forest-dominated riparian vegetation buffer during winter, November 1 through April 1, and constitute a “take” situation.

There are no records of bald eagles killed in the PAPA. Bald eagles have been killed by vehicles in the region during winter and at other times as they feed on roadside carrion (FWS, 1999). Some level of risk and direct impact to bald eagles may occur by winter traffic that would otherwise be absent with no winter drilling.

<u>Black-footed Ferret.</u> The FWS (2004a) determined that approximately 64 square miles of the PAPA (all or portions of Townships 29 North through 31 North, and Ranges 109 West through 111 West) are within the Big Piney Prairie Dog Complex in which surveys for black-footed ferrets are recommended. The remainder of the PAPA has been cleared for any further need to conduct surveys for black-footed ferrets (FWS, 2004a).

FWS concurred with BLM’s determination for the PAPA DEIS (BLM, 1999a) that project activities were not likely to adversely affect black-footed ferrets. That concurrence was based on mitigating measures provided in the PAPA ROD (BLM, 2000b) including:

- examining construction sites prior to surface disturbance for presence of prairie dog colonies;
- avoiding disturbance to prairie dog colonies that meet criteria as suitable habitat for black-footed ferrets;
- if colonies can not be avoided, conducting surveys for black-footed ferrets; and
- if black-footed ferrets or signs are detected during surveys, immediately stopping all actions that may affect black-footed ferrets and reinitiating Section 7 review with FWS.

Vehicles have killed black-footed ferrets (records in Kinter and Martin, 1992). The North Anticline Road is within 0.5 mile of white-tailed prairie dog colonies that have not been exempted by FWS (Township 31 North, Range 109 West) from recommended surveys for black-footed ferrets (FWS, 2004a). Until surveys have been conducted, the colonies remain as potential habitat for black-footed ferrets. There is no evidence to suggest black-footed ferrets are or have been present in the colonies. If black-footed ferrets are present in the PAPA, there would be some risk of vehicle related mortality associated with all alternatives due to increased traffic above current levels. However, the risk of vehicle mortality or other sources to harm black-footed ferrets by any alternative is extremely minute, and probably non-existent.

<u>Kendall Warm Springs Dace</u>. This species is limited to habitat in the Bridger-Teton National Forest, approximately 30 miles north of Pinedale, and would not be affected by any of the alternatives.

<u>Grizzly Bear</u>. Suitable habitat is not present within the PAPA, and grizzly bears are not likely to occur in the area. Further, WGFD’s policy is to limit grizzly bear occurrence outside of the occupancy area boundary established in the Wyoming Grizzly Bear Management Plan. The PAPA is not within the occupancy area boundary. None of the alternatives would affect grizzly bears.

<u>Canada Lynx</u>. Absence of montane, forested habitat precludes Canada lynx from occurring within the PAPA. Canada lynx would not be affected by any of the alternatives.

<u>Ute Ladies’-tresses Orchid</u>. This species has not been detected within the PAPA and available information indicates it is not present (Fertig, 2000). Further, there are no records of this

species' presence in southwest Wyoming. The species would not be affected by any of the alternatives.

Gray Wolf. Though occupied ranges of wolves introduced to Yellowstone National Park has expanded to include the region north and east of the PAPA, their presence in the PAPA is not expected. Wolves tend to avoid areas where human related activities occur (Paradiso and Nowak, 1982), although they have preyed on domestic livestock as well as elk at winter feedgrounds in the region. Wolves depredating on livestock in the PAPA would likely be subject to control actions (FWS et al., 2006). There is a remote possibility that wolves might prey on mule deer or pronghorn wintering in the PAPA. It is impossible to predict if wolves would pursue elk or other big game wintering in the PAPA. The gray wolf would not be affected by any of the alternatives.

Colorado River Fish. The FWS has determined that any withdrawal of water from the Colorado River System will jeopardize the following listed species: Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, all of which may inhabit the Colorado River System downstream from the PAPA in the Green River, below Flaming Gorge dam.

Primary threats to the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker are stream flow regulation and habitat modification, including coldwater dam releases, habitat loss, and blocked migration corridors, as well as competition from nonnative fish species, pesticides, and pollution (FWS, 2002a, 2002b, and 2002c). Flow recommendations have been developed for some waters in the Upper Colorado River Basin. The recommendations were designed to enhance habitat complexity (i.e., suitable spawning areas and inundation of flood plain areas), and to restore and maintain ecological processes (i.e., sediment transport and food production) that are believed to be important for the life history and subsequent recovery of the endangered pikeminnow (FWS, 2002a, 2002b, and 2002c).

The Recovery and Implementation Program (RIP) for Endangered Fish Species in the Upper Colorado River Basin was established in 1988 to mitigate for water depletion impacts. Under the RIP, water depletions from tributary waters within the Colorado River Basin are considered to jeopardize the continued existence of these fish species. The provisions for the RIP were based upon appropriate legal protection of the in-stream flow needs of the endangered Colorado River fishes. To ensure the survival and recovery of listed fish species, any single incremental withdrawal of 100 acre-feet (annual average) or more would require the water user to make a payment to the RIP. The current depletion fee (as of October 2005) is $16.67/acre-foot. The fee would be applied to the average annual depletion from the Colorado River System, averaged over the life of the action. Water use and depletion includes evaporative loss and consumption of surface and groundwater within the Green River Basin.

For development within the PAPA, water would be withdrawn from the New Fork River for hydrostatic testing of trunk pipelines, gas and liquids gathering systems, and for dust control during pipeline construction. Groundwater supply wells provide drilling water on certain well locations; however, groundwater use in the PAPA is declining due to water re-use. The total water withdrawal and average annual depletion for each alternative is provided below, in Table 4.19-2. This water would be subject to the RIP for Endangered Colorado River fish and depletion fees may apply. Produced water from the PAPA, if surface discharged, would be returned to the Colorado River Basin. Although it would not be subject to depletion fees as it is produced, it may be considered as a contribution, and if so, there would be no net depletion associated with the project. The determination of effect to the Colorado River Fish species will be addressed in BLM's Biological Assessment for the project and by their Biological Opinion which will be prepared at the conclusion of consultation with BLM. It will be determined at that time if the project would be subject to the depletion fee.

Table 4.19-2
Estimated Surface and Groundwater Withdrawals in the PAPA subject to the Recovery and Implementation Program for Endangered Fish Species by Alternative

Water Use	Surface Water Withdrawal (acre-feet)				
	No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Surface Water Withdrawal Pipeline Hydrostatic Testing					
Gas gathering	2.5	2.2	2.16	2.8	2.89
Liquid gathering	0.16	2.5	2.5	3.1	3.1
30-inch Mesa loop	8.5	8.5	8.5	8.5	8.5
10-inch water trunk line	1.5	1.5	1.5	1.5	1.5
12-inch gas line	0.7	0.7	0.7	0.7	0.7
Liquid gathering trunk lines	0.0	0.20	0.20	0.20	0.20
Water redistribution lines	0.0	0.1	0.1	0.1	0.1
Pipeline interconnection	0.0	0.4	0.4	0.4	0.4
Surface Water Withdrawal Dust Control During Pipeline Construction	12.1	30.6	30.2	37.1	37.1
Groundwater Withdrawal	2,280	2,900	8,800	2,900	8,800
Total Depletion	2,292.1	2,930.6	2,930.6	8,830.2	8,830.2
Average Annual Depletion[1]	458.4	586.1	586.1	519.4	519.4
Average Annual Contribution[2]	705.7	705.7	705.7	705.7	705.7

[1] Average annual depletion based on 5 year development period for No Action Alternative and Proposed Action Alternative and Alternative C through 2011. Average annual depletion based on 17 year development period for Proposed Action Alternative and Alternative C through 2023.
[2] Based on 630,000 gallons per day (1.93 acre-feet per day) of surface discharge at Anticline Disposal Facility. This represents the permitted maximum allowable discharge. Discharge would begin in 2007.

Special Status Wildlife Species. Under all alternatives, additional surface disturbances within areas currently covered by native vegetation (especially the large areas of sagebrush steppe, desert shrub, and mixed grass prairie) are expected to indirectly impact some BLM Sensitive Species. Those species probably include: ferruginous hawks, mountain plovers, long-billed curlew, burrowing owls, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewers sparrow, sage sparrow, pygmy rabbits, white-tailed prairie dogs, and spotted bats. These species have either been documented in the PAPA or their presence was judged to be possible in Chapter 3 (see Table 3.21-2). Merlins, fringed myotis, and long-eared myotis have either been documented as inhabitants or possibly inhabit forest-dominated riparian vegetation in the PAPA, and could be indirectly impacted by project related activities within the habitat. Likewise, surface disturbances in wetlands (and possibly irrigated croplands) could affect northern leopard frogs, western boreal toads, snowy egrets, white-faced ibis, and trumpeter swans. Adverse effects to surface water quality could indirectly impact roundtail chubs, bluehead suckers, and flannelmouth suckers, all of which are included as BLM Sensitive Species. Many of these species have special status as determined by WGFD (see Table 3.21-2). A comparison of the disturbance of habitats used by special status species by alternative is provided in Table 4.19-3.

Table 4.19-3
Surface Disturbance in Relation to Habitats used by Special Status Wildlife Species by Alternative

Special Status Wildlife Species Habitat Component	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Sagebrush steppe	3,864.1	3,313.6	4,874.3	4,986.9	8,865.2	9,112.9
Mixed grass prairie	409.1	380.6	760.6	646.5	1,126.1	1,001.0
Greasewood flats	46.9	84.2	79.3	71.2	234.7	226.0
Desert shrub	286.5	261.3	596.1	453.1	938.0	978.7
Forest-dominated riparian	64.9	74.7	59.0	84.9	278.1	269.4
Wetland SRMZ	275.1	227.9	357.5	378.2	740.9	692.6
Hydrologic sub-watersheds	5,059.4	4,484.5	6,845.0	6,856.6	12,278.4	12,271.6

Pygmy rabbits inhabit the PAPA. They are active during winter, feeding almost entirely on sagebrush (Green and Flinders, 1980), and apparently have small home ranges (Green and Flinders, 1979). There is no information to indicate how the species responds to winter drilling but diminished habitat function is expected to occur within some distance from edges created by well pads, roads, pipelines, and other wellfield components within sagebrush habitats in the PAPA.

Vehicles have killed pygmy rabbits in the PAPA. The potential for such direct impact to pygmy rabbits by any of the alternatives is unknown but is expected to increase as traffic volumes increase under the Proposed Action Alternative and Alternative C.

The status of some of these special status wildlife species has been recently evaluated from data collected during annual wildlife monitoring studies prior to 2001. The area evaluated, termed the Pinedale Anticline Wildlife Study Area (PAWSA), included the PAPA and a 2-mile buffer beyond the PAPA boundary (Ecosystem Research Group, 2006).

There were 11,622 acres of prairie dog colonies within the PAWSA, mostly within sagebrush steppe, desert shrub and mixed grass prairie vegetation types. The majority of prairie dog colony areas (69 percent) in the PAWSA was found to be farther than 0.5 mile from the closest natural gas well (Ecosystem Research Group, 2006). However, 78 percent of the PAWSA was farther than 0.5 mile from the closest well and the data do not indicate that prairie dogs avoided wells, at least not within 0.5 mile.

Ferruginous hawks nest in the PAPA and within the PAWSA. Available data collected from 2003 through 2005 indicate that distance of active nests to wells varies from 1,179 feet to 17,958 feet, with an average distance of 5,873 feet. Similar analyses of distances from active burrowing owl nests to wells ranged from 379 feet to more than 27,300 feet, averaging 6,356 feet (Ecosystem Research Group, 2006). Because there are no data on nesting distributions for either species prior to wellfield development, the analysis of monitoring data developed for the PAWSA could not lead to any conclusions about effects of development on these special status species (Ecosystem Research Group, 2006). Tentative conclusions were that current NSO buffers surrounding nest sites that are stipulated by BLM on APDs extend far enough so that only the most tolerant individuals of each species nest within the current buffer distances from well pads. Nest abandonment due to wellfield development by less tolerant individuals would be a direct impact to raptors.

Special Status Plant Species. Suitable habitat for BLM sensitive plant species would be identified prior to construction of new wellfield components. Surveys would be conducted to locate sensitive plant populations, and they would be avoided during construction or otherwise conserved. Special status plant species include meadow pussytoes, Trelease's racemose milkvetch, Cedar Rim thistle, large-fruited bladderpod, Beaver Rim phlox, and tufted twinpod. Of these species, large-fruited bladderpod has been documented in the Ross Butte and Blue Rim areas of the PAPA (Fertig, 1998), within portions of the Sensitive Soils SRMZ and desert shrub vegetation. In 1998, OHV use and surface disturbing activities (road construction) were judged to be the main threats to local sensitive plant populations. Within the Blue Rim Area of sensitive soils, 590 acres potentially will have been disturbed by wellfield development by the end of 2006, though effects by those disturbances to large-fruited bladderpod are unknown.

Pipeline Corridors and Gas Sales Pipelines

Federally Listed Species. Potential impacts to threatened and endangered species from pipeline construction would be similar to impacts from wellfield development within the PAPA.

Bald Eagle. Suitable habitats for bald eagle are present along the proposed pipeline corridors. Known nesting locations and potential roost sites are present near the BFGC and OPC pipeline corridors in forest-dominated riparian vegetation habitats along the Green River. Bald eagle surveys would be conducted prior to commencement of construction activities within suitable habitats. Increased traffic along the pipeline corridors during construction activities has the potential to cause direct mortality from vehicle collisions although pipeline construction is not expected to impact bald eagles.

Black-footed Ferret. Potentially suitable habitat for black-footed ferrets is present within and adjacent to the proposed pipeline corridors. Short-term disturbance to prairie dog colonies in the Moxa Prairie Dog Complex would likely occur as a result of pipeline construction activities. Direct loss of prairie dogs, the principal prey of black-footed ferrets, would likely result from blading, grading, and trenching activities. Despite potential impacts to prairie dogs and suitable habitats for black-footed ferrets, impacts to black-footed ferrets are not expected because recent surveys in the project area failed to locate black-footed ferrets. Furthermore, additional black-footed ferret surveys would be conducted in suitable habitats prior to construction activities. If black-footed ferrets are located within 0.5 mile of proposed activities, BLM would consult with FWS to determine necessary conservation measures. These measures would ensure that pipeline construction would not adversely affect black-footed ferrets.

Kendall Warm Springs Dace. This species is limited to habitat in the Bridger-Teton National Forest, approximately 30 miles north of Pinedale, and would not be affected by construction of the pipelines.

Grizzly Bear. Grizzly bears are not likely to occur in the area of the proposed corridors. Pipeline construction would not affect grizzly bears.

Canada Lynx. Absence of montane, forested habitat precludes Canada lynx from occurring within the pipeline corridors. Canada lynx would not be affected by construction of the pipelines.

Ute Ladies'-tresses Orchid. This species has not been detected within the proposed pipeline corridors or within southwest Wyoming. Impacts to wetland habitats would be mostly avoided because rivers would be crossed by HDD construction techniques. Ute ladies'-tresses orchid are not expected to be impacted by pipeline construction.

Colorado River Fish. Water withdrawals required for hydrostatic testing and dust control during construction would be subject to the RIP for Endangered Colorado River fish. Approximately 132.1 acre-feet would be required during construction of the R6 pipeline, and approximately 113.0 acre-feet would be required during construction of the PBC and Opal Loop III pipelines (see Appendix D for specifics on water withdrawals associated with gas sales pipeline construction). The hydrostatic test water would be discharged within the Colorado River Basin, and therefore, actual depletion would be minor. The determination of effect to the Colorado River Fish species will be addressed in BLM's Biological Assessment for the project, and after consultation with the FWS, the FWS will issue a Biological Opinion. It will be determined at that time if the project would be subject to the depletion fee.

Special Status Wildlife Species. Potential impacts to BLM Sensitive Species from pipeline construction would be similar to impacts from wellfield development within the PAPA. The following sensitive species, or suitable habitats for these species, have been identified within or adjacent to the proposed pipeline corridors: ferruginous hawk, mountain plover, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewers sparrow, sage sparrow, pygmy rabbit, and white-tailed prairie dog. Long-billed curlew, sage thrasher, loggerhead shrike, grasshopper sparrow, Brewers sparrow, and sage sparrow are addressed under migratory birds in Section 4.20.3.1.

Pygmy rabbits and suitable habitats are present within and along much of the proposed pipeline corridors. Construction activities within these habitats would likely displace individuals. Ground disturbing activities have the potential to cause direct mortality of individuals but would not be likely to directly impact pygmy rabbit populations.

Prairie dog colonies associated with the Moxa Prairie Dog Complex are present within and adjacent to the proposed pipeline corridors. The species is known to colonize disturbed areas and has demonstrated an affinity towards the existing adjacent pipeline corridors. Impacts to prairie dogs from pipeline construction would likely include direct mortality of individuals, short-term disturbance and removal of habitat, and short-term reduction in forage for the species. These adverse impacts are anticipated to be short-term. Potentially beneficial long-term impacts may result from pipeline construction activities. These beneficial impacts would include improvements to forage from transitioning vegetative species composition from shrub dominance to reclamation grasses, and facilitating easier burrow development along the reclaimed pipeline right-of-way and other disturbed areas. Adverse impacts to prairie dogs would be minor and short-term.

Mountain plover habitat is present along the proposed pipeline corridors. Construction activities in these areas would be avoided during the plover nesting season between May 1 and July 15. Pipeline construction outside of this period is not likely to have adverse impacts on mountain plover due to the species' preference for disturbed ground and low vegetation.

Potential impacts to ferruginous hawk and burrowing owls are discussed above, in Section 4.19.3.1 (see discussion under Natural Gas Development within the PAPA).

Special Status Plant Species. Potential impacts to BLM sensitive plant species from pipeline construction would be similar to impacts from wellfield development within the PAPA. None of the special status plant species identified in Chapter 3 (see Table 3.21-4) are expected along any of the proposed corridor/pipeline alignments. Though unlikely, Nelson's milkvetch could occur within alkaline clay flats, shale bluffs and gullies, pebbly slopes, sparsely vegetated sagebrush and would be associated with cushion plant communities. Also, persistent sepal yellowcress, a species generally associated with sandy, muddy stream banks, stockponds, and reservoirs, could be directly impacted during pipeline construction. Once surveys for these and other special status plant species are complete, BLM would determine if any would be affected.

4.19.3.2 Alternative A (No Action Alternative)

Federally Listed Species. The only federally listed species likely to be affected by the No Action Alternative is the bald eagle. Under this alternative, an additional 1.5 acres of disturbance is expected within 1 mile of an existing (as of 2006) active bald eagle nest (Table 4.19-1). Approximately 740 acres of disturbance is expected within the 1-mile buffer of the New Fork River riparian zone, of which approximately 75 acres would be within forest-dominated riparian vegetation (Table 4.19-1).

It is estimated that 2,292.08 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 5-year development period under the No Action Alternative (Table 4.19-2). This results in an average annual depletion of 458.42 acre-feet of water over the 5-year development period.

Special Status Wildlife Species. The No Action Alternative would disturb a variety of habitats utilized by BLM sensitive species (BLM, 2002) that were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives. Expected area disturbance in habitats used by these species is shown above in Table 4.19-3.

Special Status Plant Species. The No Action Alternative is likely to affect 538 additional acres within the Blue Rim Area of sensitive soils, some of which may provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.3.3 Alternative B (Proposed Action Alternative)

<u>Proposed Action Alternative Through 2011</u>

Federally-Listed Species. Similar to the No Action Alternative, the only federally listed species likely to be affected by the Proposed Action Alternative through 2011 is the bald eagle. Only 2 acres of new surface disturbance are expected within 1 mile of an existing (in 2006) active bald eagle nest (Table 4.19-1). Approximately 860 acres of new disturbance is expected within the 1-mile buffer of the New Fork River riparian zone, of which approximately 124 acres would be within forest-dominated riparian vegetation (Table 4.19-1).

It is estimated that 2,930.6 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 5-year development period under the Proposed Action Alternative through 2011 (Table 4.19-2). This results in an average annual depletion of 586.1 acre-feet of water over the 5-year development period.

Special Status Wildlife Species. The Proposed Action Alternative through 2011 would disturb a variety of habitats utilized by BLM sensitive species (BLM, 2002) that were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives. Expected area disturbance in habitats used by these species is shown above in Table 4.19-3.

Special Status Plant Species. The Proposed Action Alternative through 2011 is likely to affect nearly 1,000 additional acres within the Blue Rim Area of sensitive soils (Table 4.15-1), some of which is likely to provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

<u>Proposed Action Alternative Through 2023</u>

Federally-Listed Species. By 2023, the conclusion of wellfield developments under the Proposed Action Alternative, 40 acres of new surface disturbances are expected within 1 mile of any existing (in 2006) active bald eagle nest (Table 4.19-1). Approximately 2,100 acres of new disturbance is expected within 1 mile of the New Fork River riparian zone, of which approximately 340 acres would be within forest-dominated riparian vegetation.

It is estimated that 8,830.2 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 17-year development period under the Proposed Action Alternative through 2011 (Table 4.19-2). This results in an average annual depletion of 519.4 acre-feet of water over the 17-year development period.

Special Status Wildlife Species. The Proposed Action Alternative through 2011 would disturb a variety of habitats utilized by BLM sensitive species (BLM, 2002) that were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives. Expected area disturbance in habitats used by these species is shown above in Table 4.19-3.

Special Status Plant Species. By 2023, the Proposed Action Alternative is likely to have affected nearly 1,500 acres total since 2006 within the Blue Rim Area of sensitive soils (Table 4-15-1), some of which may provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.3.4 Alternative C

<u>Alternative C Through 2011</u>

Federally-Listed Species. Similar to the No Action and Proposed Action alternatives, the only federally listed species likely to be affected by Alternative C through 2011 is the bald eagle. Only 2 acres of new surface disturbances are expected within 1 mile of any existing (as of 2006) active bald eagle nest (Table 4.19-1). Approximately 980 acres of new disturbance is expected within the 1-mile buffer of the New Fork River riparian zone (Table 4.19-1), of which 150 acres would be forest-dominated riparian vegetation.

It is estimated that 2,930.6 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 5-year development period under Alternative C through 2011 (Table 4.19-2). This results in an average annual depletion of 586.1 acre-feet of water over the 5-year development period.

Special Status Wildlife Species. The Proposed Action Alternative through 2011 would disturb a variety of habitats utilized by BLM sensitive species (BLM, 2002) that were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives. Expected area disturbance in habitats used by these species is shown above in Table 4.19-3.

Special Status Plant Species. Alternative C is likely to affect more than 700 additional acres within the Blue Rim Area of sensitive soils (Table 4.15-1), some of which is likely to provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

<u>Alternative C Through 2023</u>

Federally-Listed Species. By 2023 and the conclusion of wellfield developments under Alternative C, 11 acres of new surface disturbances are expected within 1 mile of any existing (in 2006) active bald eagle nest (Table 4.19-1). Approximately 1,800 acres of new disturbance is expected within the 1-mile buffer of the New Fork River riparian zone (Table 4.19-1), of which 330 acres is expected to be forest-dominated riparian vegetation (Table 4.19-1).

It is estimated that 8,830.2 acre-feet of water subject to the RIP for Endangered Fish Species in the Colorado River Basin would be used for hydrostatic testing, drilling and completions, and dust control over the 17-year development period under Alternative C through 2023 (Table 4.19-2). This results in an average annual depletion of 519.4 acre-feet of water over the 17-year development period.

Special Status Wildlife Species. The Proposed Action Alternative through 2011 would disturb a variety of habitats utilized by BLM sensitive species (BLM, 2002) that were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives. Expected area disturbance in habitats used by these species is shown above in Table 4.19-3.

Special Status Plant Species. By 2023, Alternative C is likely to have affected more than 1,400 acres total since 2006 within the Blue Rim Area of sensitive soils (Table 4.15-1), some of which is likely to provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.4 Cumulative Impacts

Federally Listed Species. The only federally listed species likely to be affected by cumulative impacts due to past, present and foreseeable future wellfield development in the PAPA is the bald eagle. The CIAA related to bald eagles includes the area administered by the BLM's PFO. Throughout the species' range in the conterminous United States, bald eagles have been adversely affected by human related direct mortality (shooting, poisoning including by pesticide residues, electrocution, collisions with vehicles, wind turbines, and powerlines), and human disturbances that interrupt reproduction and survival of young (FWS, 1999). Within the area managed by the BLM PFO, principal threats to bald eagle nesting habitat were judged to be from recreation and livestock grazing. Likewise, livestock grazing had been the principal land use near potential wintering habitats along the New Fork and Green rivers The river corridors supported concentrated foraging habitats and, though mostly on private lands, livestock grazing was the predominant land use (BLM, 2003d).

Cumulative impact analysis to bald eagle habitats in the PAPA is based on past, present, and future levels of surface disturbances shown in Table 4.19-4. Existing non-wellfield disturbance within 1 mile of existing bald eagle nest sites and within 1 mile of the New Fork River riparian zone appear substantial, but are mainly due to irrigated and non-irrigated croplands in those areas of the PAPA. Roads, residential developments, and some urban infrastructure (e.g., Wenz Field) have contributed to past disturbances within those bald eagle habitats. Only minor non-wellfield disturbance has occurred in forest-dominated riparian vegetation, primarily from construction of roads and residences. By the end of 2006, disturbances to each of the three areas by existing wellfield developments are relatively minor. However, surface disturbances within the 1-mile buffer of the New Fork River riparian zone has been subject to the most wellfield development of the three areas (Table 4.19-4).

Implementation of any of the alternatives would generate considerable cumulative disturbances to bald eagle habitats, even if existing non-wellfield disturbance is ignored, as shown in Table 4.19-4. Through 2011, each of the alternatives would cumulatively affect somewhat similar areas within 1 mile of nests, 1 mile of the New Fork River riparian zone, and within forested-dominated riparian vegetation. Compared to the No Action Alternative through 2011, there would be more cumulative impact by the Proposed Action Alternative and Alternative C to bald eagle habitats by 2023 (Table 4.19-4). Cumulative impact to bald eagle habitats under the Proposed Action Alternative through 2023 would be similar to that under Alternative C through 2023.

Table 4.19-4
Cumulative Surface Disturbance in Relation to 1-Mile Buffer of Bald Eagle Habitats by Alternative

Bald Eagle Habitat Component	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
1 mile of Active Bald Eagle Nests	921.5	48.7	971.7	972.5	972.5	1,009.9	981.0
1 mile of New Fork River Riparian Zone	4,589.7	828.1	6,238.7	6,360.9	6,483.1	7,581.7	7,331.9
Forest Dominated Riparian Vegetation	15.4	64.9	162.3	146.6	172.5	365.7	357.0

Water withdrawals from the Colorado River Basin by other projects have contributed and will continue to contribute cumulative impacts to endangered Colorado River fish species. As noted above, withdrawals of 100 acre-feet or more from any project would be subject to payments under the RIP for Endangered Colorado River fish.

Special Status Wildlife Species. Implementation of any of the alternatives would result in cumulative disturbance to a variety of habitats utilized by BLM sensitive species (Table 4.19-5). These were described above under Special Status Wildlife Species in Section 4.19.3.1 – Summary of Impacts Common to All Alternatives. Existing non-wellfield disturbances to those habitats were addressed in earlier sections of this chapter.

Table 4.19-5
Cumulative Disturbance in Relation to Habitats used by Special Status Wildlife Species by Alternative

Special Status Wildlife Species Habitat Component	Existing Non Wellfield Disturbance (acres)	Estimated Existing Wellfield Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Sagebrush steppe	963.5	3,864.1	8,435.3	9,996.0	10,108.6	13,986.9	14,234.6
Mixed grass prairie	35.3	409.1	859.4	1,239.4	1,125.3	1,604.9	1,479.8
Greasewood flats	18.2	46.9	149.3	144.4	136.3	299.8	291.1
Desert Shrub	27.4	286.5	639.5	974.3	831.3	1,316.2	1,356.9
Forest-dominated riparian	15.4	64.9	162.3	146.6	172.5	365.7	357.0
Wetland SRMZ	2,444.7	275.1	2,968.5	3,098.1	3,118.8	3,481.5	3,433.2
Hydrologic sub-watersheds	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**

Through 2011, each of the alternatives would cumulatively affect similar areas within most habitats utilized by special status species. However, cumulative impact to sagebrush steppe and mixed grass prairie by the Proposed Action Alternative and Alternative C would exceed cumulative disturbance by the No Action Alternative. Compared to the No Action Alternative however, there would be far more cumulative impact by the Proposed Action and Alternative C to all sensitive species' habitats by 2023.

Special Status Plant Species. Cumulative impacts by the Proposed Action and Alternative C are likely to affect areas than the No Action Alternative within the Blue Rim Area of sensitive soils by 2011 (see Table 4.15-2). Compared to the No Action Alternative however, there would be more cumulative impact by the Proposed Action and Alternative C to habitats in the Blue Rim Area by 2023, some of which may provide habitat for populations of large-fruited bladderpod and possibly other BLM-Sensitive plant species.

4.19.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to threatened, endangered, and special status species would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.20 WILDLIFE AND AQUATIC RESOURCES

4.20.1 Scoping Issues

The following concerns related to wildlife and aquatic resources were received during public scoping:

1. Document how the operators' proposal, including removal of seasonal stipulations, would provide compensation and/or protection for mule deer, pronghorn, and greater sage-grouse at least equal to enforcing those stipulations.
2. Concern that winter drilling will contribute to declines in mule deer, pronghorn, and greater sage-grouse populations as a result of lost habitat, ineffective habitat, roadkills, and/or disease.
3. Continue and/or expand existing wildlife studies while making data and study results available to the public.
4. BLM should consider short-term impacts (5 to 20 years) to wildlife (mule deer, pronghorn and greater sage-grouse) and their habitats as well as long-term impacts.
5. Address any deviations from the Wyoming Game and Fish Department's "*Minimum Recommendations for Development of Oil and Gas Resources Within Crucial and Important Wildlife Habitats on BLM Lands*."
6. BLM should consider off-site mitigation strategies in the region, beyond the agency's administrative boundaries (including reducing impact on big game summer range and restricting development on undeveloped or suspended oil and gas leases), to offset impact to wildlife in the PAPA and potential conflicts with people and other wildlife by off-site mitigation.
7. BLM should ensure that some portion of the PAPA remains unfragmented and undisturbed.

8. BLM should monitor the implementation and effectiveness of applicant-committed mitigation measures and effects of current development over the long-term to allow for better management of continued and future development.

4.20.2 Impacts Considered in the PAPA DEIS

In the PAPA DEIS (BLM, 1999a), BLM considered direct and indirect impacts to wildlife as explicitly related to wellfield development in the PAPA. Direct impacts include:

- mortality from wildlife-vehicle collisions on or off the PAPA;
- mortality during road, pipeline and well pad construction and other surface-disturbing actions;
- mortality due to consumption of, or exposure to, toxic compounds; and
- interruption or interference with life history functions including courtship, nesting and parturition, migration, and winter survival.

Potential indirect impacts to wildlife considered in the PAPA DEIS included:

- fragmentation of connected habitats;
- removal of vegetation and other features, such as rock outcrops, that provide habitat;
- degradation of terrestrial habitats from erosion and introduction of nonnative vegetation;
- degradation of aquatic habitats due to altering stream banks, siltation, and decreased water quality;
- loss of forage for herbivores; and
- diminished animal use of habitats due to effects of noise, dust, emissions, and human presence.

Anticipated direct and/or primary impacts to wildlife include all effects directly related to the alternatives (Anderson, 1985 and Comer, 1982). Primary impacts can result from disturbance and/or wildlife mortality and/or disturbance that interferes with requisite life-history functions (e.g., feeding, reproduction) during wellfield development and operation.

Indirect impacts may also be primary impacts because they are related to, but removed from, an action by an intermediate step or process. For wildlife, indirect impacts are often associated with alteration, elimination, or degradation of habitats. Indirect effects may result from induced changes to wildlife habitats, principally by conversion of one vegetation cover type to another or by fragmentation of existing wildlife habitats. Indirect impact to habitats decreases their functional capacity to support wildlife populations at non-impacted levels.

Alternatively, indirect impact may be a secondary, rather than primary, effect of the project or alternative. Secondary impacts of a project on wildlife most commonly follow an increased human population base and increased access, either as a result of the requirements of the action itself (the workforce needed to construct or operate the project) or as a consequence of the action (need for ancillary goods, services, or opportunities resulting from the project). Potential secondary effects of a project often are associated with increased recreation demand including hunting or OHV use, habitat degradation by human encroachment, and increased illegal harvest (Anderson, 1985; Comer, 1982).

For some species direct impacts are expected to be interrelated, such as the effects of habitat fragmentation on interference with life history functions. There will probably be indirect or secondary impacts that ensue with increased human presence and/or increased human use (access) of an area. Direct impacts could occur during the project and after, but are functionally related to secondary impacts. Secondary impacts would not occur without the project. Once initiated though, secondary impacts may continue well beyond the project and may further develop independently of the project. While the effects of secondary impacts on wildlife may be the same as primary, direct impacts, BLM identified that potential sources of those impacts vary and include:

- increased recreation, especially off-highway vehicles;
- increased habitat conversion, especially urban/suburban sprawl;
- habitat degradation by human encroachment;
- increased noise, air, and water pollution;
- increased game poaching;
- increased wildlife road kills; and
- increased harassment of wildlife by uncontrolled pets, especially dogs.

BLM considered that impacts to wildlife would be significant if any of the following occurred as a direct or indirect result of development in the PAPA:

- increased mortality and/or decreased survival of native wildlife species considered as Vital, High, or Moderate by the WGFD Mitigation Policy;
- loss of habitat function and/or habitat value for habitats classified as Vital or High by the WGFD Mitigation Policy; or
- net loss of habitat value with alterations in habitat function for habitats classified as Moderate by the WGFD Mitigation Policy.

Based on these criteria, significant impacts were predicted for a number of wildlife species by the PAPA DEIS (BLM, 1999a). Evidence collected since the PAPA DEIS has shown that the functions of some wildlife habitats, those classified as “vital” or “high value” by WGFD, have declined as wellfield developments have progressed. Such evidence has been based on species’ use of habitats before and after development. In other cases, species’ use of habitats proximate to disturbance has declined whereas use of habitats farther away from disturbance has not. Diminished habitat function is a significant indirect impact that may ultimately directly affect wildlife populations through increased mortality and/or decreased births (fecundity). Such direct impact though, has not yet been conclusively demonstrated.

4.20.3 Alternative Impacts

4.20.3.1 Summary of Impacts Common to All Alternatives

Natural Gas Development within the PAPA

Since issuance of the PAPA DEIS (BLM, 1999a), many of the impacts to wildlife that were predicted have been substantiated by wildlife studies conducted cooperatively by the Operators, BLM, WGFD, and the University of Wyoming. Impacts resulting from removal of vegetation are discussed in other sections in this chapter, including Surface Water (Section 4.14), Vegetation (Section 4.16), and Wetlands (Section 4.18).

Habitat Fragmentation and Effectiveness. Fragmentation of connected habitats by wellfield development was predicted in the PAPA DEIS (BLM, 1999a) and concern about fragmented habitat in the PAPA was indicated during public scoping for this Draft SEIS. Fragmentation refers to breaking up contiguous areas of vegetation/habitat into smaller patches that become progressively smaller and isolated over time (Forman, 1995). Among other effects, fragmentation of habitat allows predator access to breeding sites used by birds along newly created corridors and through edges of habitats that were previously continuous. Habitat fragmentation contributes to higher rates of nest predation in grasslands (Burger et al., 1994; Vickery et al., 1994) and at habitat edges (Gates and Gysel, 1978; Marini et al., 1995).

Measures of habitat fragmentation projected by the end of 2006, and estimated for each of the alternatives, are provided in Table 4.20-1. Well pad numbers provide some indication of the number of disturbed patches within otherwise contiguous vegetation or habitat; more disturbed patches indicate more fragmentation. By this measure (the number of well pads), the No Action Alternative would create more fragmentation than the other alternatives by 2011 with a total of 245 new well pads. Under the Proposed Action Alternative and Alternative C through 2011, 179 new well pads would be constructed. Habitat fragmentation would be similar under the Proposed Action Alternative and Alternative C through 2011. By 2023, the Proposed Action Alternative and Alternative C would each have 250 new well pads (Table 4.20-1). Therefore, habitat fragmentation would be similar under these two alternatives by 2023.

Each well pad could be considered as a patch of altered or unusable wildlife habitat. In 2006, the average size of well pads was approximately 7 acres (Table 4.20-1). Due to increased size of new well pads and expansion of existing pads, the average patch area would increase to 8 acres for pads developed under the No Action Alternative and to 11 acres for pads developed through 2011 under the Proposed Action and Alternative C. Additional construction of new pads and further expansion of existing pads through 2023 under the Proposed Action and Alternative C would lead to average well pad patches of nearly 18 acres (Table 4.20-1). Fragmentation due to the patchiness of altered or unusable wildlife habitat within undisturbed vegetation would be most extensive under the Proposed Action Alternative and Alternative C by 2023.

Another measure of fragmentation is the amount of edge created by wellfield development. In the context of habitat fragmentation, edge is the portion of habitat (or ecosystem on a larger scale) "*near its perimeter, where influences of the surroundings prevent development of interior environmental conditions*" (Forman, 1995). An estimate of the perimeter of each existing pad, new pad, and expansion pad was derived from the pad areas. Well pad perimeters were computed as the average of a circular well pad (circumference) and a square (a conservative estimate because most pads are rectangular and perimeters of rectangles can greatly exceed those of circles and squares with the same areas). The estimated total perimeter for the 348 existing well pads projected by the end of 2006 is 134 miles. Roads and pipelines also create edges when constructed through undisturbed habitat. An indication of fragmentation is the total length of wellfield roads and pipelines in Table 4.20-1, a measure that does not include each side of a road or pipeline corridor nor does it include possible co-locations of multiple pipeline corridors or pipelines located directly adjacent to roads. There is no way to anticipate future contiguity of these linear elements. By the end of 2006, a total of 369 miles of edge from roads and pipelines, combined is expected within the PAPA. When added to total well pad perimeters, there would be an estimated 503 miles of edge in the PAPA by the end of 2006 (Table 4.20-1).

The amount of edge length would increase under each of the alternatives. There is less total edge length for the No Action Alternative than under either of the other two alternatives by 2011. This is because the liquids gathering system included in the Proposed Action Alternative for the central and southern portions of the PAPA would not be installed under the No Action Alternative. Substantial edge length would be associated with the proposed liquids gathering system. The amount of edge length created under Alternative C would be similar to the edge length created under the Proposed Action Alternative by 2011 and through 2023.

Table 4.20-1
Potential Edge Length Indicative of Fragmentation by Alternative

Wellfield Component	Well Pads and Estimated Existing Edge Length by the end of 2006	Additional Well Pads and Potential Edge Length (miles) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Total Well Pad Number	348	245	179	179	250	250
Well Pad Size (acres)	7.0	8.4	11.1	11.1	17.6	17.6
Well Pad Perimeter (miles)	133.6	104.3	111.3	111.9	221.7	222.5
Road Length[1] (miles)	215.2	108.0	88.7	89.3	120.8	120.8
Pipeline Length [2] (miles)	154.2	149.7	382.7	383.8	474.0	472.9
Total Edge Length (miles)	**503.0**	**362.0**	**582.7**	**585.0**	**816.5**	**816.2**

[1] Includes all new roads (local and resource) in the PAPA.
[2] Includes all new pipelines (gas gathering, liquids gathering, and trunk pipelines) in the PAPA.

Habitat Function. Since the PAPA DEIS, WGFD (2004b) developed guidance relevant to current and future natural gas development in the PAPA, *Recommendations for Development of Oil and Gas Resources Within Crucial and Important Wildlife Habitats*, in which evaluation of impact by varying levels of oil and gas development is related to the function of wildlife habitats. Habitat function is defined (WGFD, 2004b) as "*the arrangement of habitat features, and the features' capability to sustain species, populations, and diversity of wildlife over time*." Impacts that decrease habitat function render the habitat less effective. As the effectiveness and ultimately the function of the habitat is diminished, a species' or population's use of the habitat is expected to diminish as a direct or indirect result of the impact.

WGFD (see 2004b) identified vital wildlife habitats for which they recommend no loss of habitat function, although, "*some modification of habitat characteristic can take place*." The vital wildlife habitats include big game crucial winter ranges, greater sage-grouse habitats (leks, nesting and brood-rearing complexes, winter habitat), raptor nesting habitats, and habitats used by native species with NSS1 and NSS2 status (Table 3.21-2).

All of the vital habitats for big game, greater sage-grouse, raptors, and a few high priority native species are in the PAPA. WGFD also defined high value habitats (big game parturition areas, riparian habitats, habitats of NSS3 species) for which WGFD recommends no loss of habitat function within the biological community that encompasses the project impact site. Impact to high value habitat can be mitigated within the affected biological community (WGFD, 2004b). Though no specific big game parturition areas have been identified in the PAPA, other high value habitats are present including riparian habitats and habitats utilized by NSS3 species (for example pygmy rabbits, ferruginous hawks, white-tailed prairie dogs, and merlins). As discussed below under specific wildlife species, the function of some vital and high value habitats in the PAPA has diminished as wellfield development has progressed.

Big Game.

<u>Pronghorn</u>. Wellfield development in the PAPA has led to surface disturbance within pronghorn seasonal habitats, including crucial winter ranges (Table 4.20-2). Surface disturbance in crucial

pronghorn winter range would increase under each of the alternatives (Table 4.20-2). Compared to the No Action Alternative, the Proposed Action Alternative and Alternative C would result in more disturbance to pronghorn crucial winter range through 2011, although disturbance would be similar under the two alternatives. Surface disturbance under the Proposed Action Alternative and Alternative C would be similar through 2023. Effects to noncrucial pronghorn spring/summer/fall ranges in the PAPA have been substantial and would continue with increased disturbance under all of the alternatives by 2011 and through 2023.

Table 4.20-2
Surface Disturbance in Relation to Pronghorn Seasonal Ranges by Alternative

Pronghorn Seasonal Ranges	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Crucial Winter Range SRMZ	1,619.0	1,534.1	2,460.1	2,611.9	4,371.1	4,179.2
Spring/Summer/Fall Range	3,440.5	2,950.4	4,384.9	4,244.7	7,907.3	8,092.4
Winter Range	0.0	0.0	0.0	0.0	0.0	0.0
Total	**5,059.4**	**4,484.5**	**6,845.0**	**6,856.6**	**12,278.4**	**12,271.6**

There has been direct impact (area of lost habitat) to pronghorn habitats, at least until revegetation of disturbed surface is successful. Also, pronghorn utilizing crucial winter range generally avoid areas where wellfield development is concentrated (Berger et al., 2006), an example of decreased habitat function even though vegetation has not been physically removed. The ongoing study, by Berger et al. (2006), included the PAPA and the Jonah Field Project Area. After the first year of the study, none of the study animals utilized the Jonah Field Project Area. Analyses of preliminary results indicate that habitat patches of less than about 600 acres are under-utilized or abandoned by wintering pronghorn (Berger et al., 2006). If future study results are similar, increased surface disturbance on crucial winter range that lead to habitat patchiness would likely contribute to diminished effectiveness and lost function of pronghorn habitats in the PAPA under all of the alternatives. Lost habitat and diminishing habitat function may eventually lead to population declines but such demographic response to impact is most likely after some time has elapsed.

Under the Proposed Action Alternative and Alternative C, a liquid gathering system would be installed in the central and southern portions of the PAPA, connecting most producing wells with 2 years of issuance of the ROD. The liquids gathering system would not be installed under the No Action Alternative. Liquids gathering systems reduce daily traffic to producing wells year-round. Decreased traffic as a result of the liquids gathering system would benefit wintering big game, including pronghorn, but is not expected to compensate for traffic associated with wellfield development (drilling and completions) and specifically, traffic during winter with year-round drilling. Once wellfield development is complete and traffic is only related to production, there would be a large decrease in wellfield traffic. Wellfield development during winter would reduce habitat effectiveness under all alternatives.

<u>Mule Deer</u>. Mule deer habitat in the PAPA has been directly impacted by surface disturbance. Approximately 58 percent of existing disturbance in the PAPA is within crucial mule deer winter range (Table 4.20-3). Year-round drilling would be allowed in crucial winter range under the

Proposed Action Alternative and Alternative C, whereas it would not occur in crucial winter range under the No Action Alternative. The estimated surface disturbance to crucial winter range under the Proposed Action Alternative and Alternative C. through 2011 will likely increase existing disturbance by more than 2,000 acres, roughly twice the estimated surface disturbance anticipated under the No Action Alternative (Table 4.20-3). By 2023, existing disturbance within mule deer crucial winter range is expected to increase by about 3,500 acres under the Proposed Action Alternative and Alternative C.

Mule deer in the Sublette Herd Unit, including those inhabiting winter ranges in the PAPA, have been intensively studied since 1998. Phase II of the Sublette Mule Deer Study has been in progress since 2002, continuing as wellfield development progresses. Available information, since 2002, indicates that the mule deer population on the Pinedale Mesa steadily declined from more than 5,000 animals in 2002 to less than 3,000 animals in 2004-2005 (Sawyer et al., 2005a). Mule deer abundance during winter 2005-2006 was nearly the same as for the previous winter (Sawyer, 2006). Mule deer abundance in the Pinedale Front control area showed no similar trend.

Table 4.20-3
Surface Disturbance in Relation to Mule Deer Seasonal Ranges by Alternative

Mule Deer Seasonal Ranges	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Crucial Winter Range SRMZ	1,518.8	1,090.5	2,213.7	2,097.7	3,587.8	3,411.4
Spring/Summer/Fall Range	59.6	0.0	0.0	0.0	0.0	0.0
Winter Range	1,011.6	1,093.8	1,669.2	1,823.9	2,818.2	2,323.8
Winter/Yearlong Range	27.7	0.0	0.0	0.0	0.0	0.0
Total	**2,617.7**	**2,184.3**	**3,882.9**	**3,921.6**	**6,406.0**	**5,735.2**

Since issuance of the PAPA ROD (BLM, 2000b), direct loss of habitat has increased annually within mule deer crucial and noncrucial winter ranges in the PAPA and would continue under each alternative (Table 4.20-3). Another aspect of the Sublette Mule Deer Study has focused on distribution of wintering mule deer prior to and since wellfield development on the Mesa. Only 60 percent of mule deer habitats that were classified as high-use areas before development in 2000 were classified as high-use areas in the first year since the PAPA ROD. In the second year of development, only 49 percent of the predevelopment high-use areas were classified as high-use. By the third year of development, only 37 percent of initial high-use areas were classified as high-use areas (Sawyer et al., 2006).

Winter 2003-2004, the fourth year of the study, was more severe than the previous three winters. Although mule deer abundance further declined on the Mesa, the remaining deer inhabiting the PAPA during winter 2003-2004 were closer to wellfield development than in the previous 3 years. Seventy-seven percent of the predevelopment high-use areas were highly used, though by fewer deer (Sawyer et al., 2005a). It appears that mule deer utilizing winter range in 2003-2004 may have been more tolerant of wellfield development, at least when severe winter conditions rendered habitats near wellfield development apparently more suitable than habitats farther away. Winter conditions in 2004-2005 were mild and mule deer once again were distributed farther from well pads and roads than during the previous severe winter, highly used mule deer habitats included only 52 percent of predevelopment high-use areas (Madson, 2006). The study has shown that crucial winter ranges in the PAPA are less effective than they were before wellfield development and some level of habitat function has been lost. Further loss of habitat effectiveness and habitat function may continue as more development occurs under each of the alternatives.

Mule deer in the PAPA avoid roads with different levels of traffic. During winter 2005-2006, deer distances from roads with very high traffic volumes (263 to 350 vehicles/day) averaged about 4 miles. Distances of deer from roads with high volumes (77 to 152 vehicles/day) averaged 2.9 miles; distances from roads with medium volume (19 to 30 vehicles/day) averaged 1 mile; and distances from closed or low use roads (0 to 12 vehicles/day) averaged 0.5 mile. Deer distances to well pads with liquids gathering systems averaged 1.5 miles, while distances to pads without a liquids gathering system averaged more than 3 miles (Sawyer, 2006). These data show the negative effects of traffic on wintering mule deer distribution but also the benefits of a liquid gathering system. Under the Proposed Action Alternative and Alternative C through 2011, winter traffic would increase above existing levels with year-round drilling. Even though both of these alternatives would have a liquid gathering system and the No Action Alternative would not, winter traffic would still be increased over levels for the No Action Alternative due to the increase in traffic related to drilling and completions.

Mule deer avoidance of roads with very high and high traffic volume would likely become more extensive throughout the crucial winter range as roads with higher traffic volumes proliferate. Mule deer would avoid habitats adjacent to roads with higher traffic volumes by up to 3 or 4 miles under all alternatives. Crucial winter habitat in all areas adjacent to wellfield development, especially habitats proximate to well drilling locations and roads with high traffic volume, would remain ineffective as mule deer habitat for the duration of wellfield development. Once all wells are productive, traffic volumes year-round would be relatively low due to the use of liquids gathering systems under the Proposed Action Alternative and Alternative C. This would not be the case under the No Action Alternative.

Over-winter mule deer fawn and adult survival is a function of demographic response to habitat quality and quantity. Over-winter fawn survival on the Mesa (impacted study area) and on the Pinedale Front (unimpacted control area) has been similar each year until winter 2005-2006 when the mortality rate was significantly higher in the control area (Wildlife Technical Report, Appendix K), though the reason for the difference is not clear. The fawn mortality rate observed on the Mesa following winter 2005-2006 was within range of the expected rate given winter snowfall, precipitation during the two previous growing season, and temperature at the onset of winter. The fawn mortality rate on the Pinedale Front was significantly higher than expected, based on measured winter conditions. Because a smaller proportion of mule deer utilize the Mesa crucial winter range complex than in the past, over-winter mortality on other crucial winter ranges (e.g., the Pinedale Front Complex) would become proportionately more significant to the entire population, regardless of the cause of mortality there. The results emphasize the importance of all crucial winter ranges to the population.

There is a growing body of research that indicates time lags between landscape changes and population, or demographic, responses to the changes (Nagelkerke et al., 2002). Examples of time lag responses have been reported for roads. As roads through previously unaffected wildlife habitat proliferate resulting in lost habitat, reduced habitat quality (or habitat effectiveness), increased vehicle-related mortality, and increased fragmentation (decreased habitat connectivity), declining populations follow but some time after the initial impact of road construction (Forman et al., 2003).

For mule deer in the Sublette Herd Unit, there has not been a demographic response related to over-winter survival. There is potential for a declining population, given a time lag between lost habitat effectiveness and function and a population-level response. Current understanding is insufficient to predict how such a demographic response would be manifested, but decreased mule deer survival on or off winter range is one possibility. Other demographic responses that may be observed in the future include overcrowding and over-utilization of unaffected habitats within increased intraspecific competition, increased prevalence of disease, predation, physiological stress response, and decreased birth rates, all of which could occur in some combination and at varying levels as the extent of wellfield development increases under any of the alternatives. Any demographic response to wellfield development would be a significant impact.

Moose and Elk. Approximately 252 acres of moose crucial winter/yearlong range would be disturbed by wellfield development by the end of 2006. Additional surface disturbance in moose crucial winter/yearlong range is expected under each alternative (Table 4.20-4). Moose response to roads and traffic in crucial winter/yearlong range has not been documented. No new disturbance is likely in the portion of elk winter range coinciding with the PAPA.

Table 4.20-4
Surface Disturbance to Moose and Elk Seasonal Ranges by Alternative

Seasonal Range	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Moose Crucial Winter/Yearlong Range	252.5	248.8	244.2	290.5	756.5	642.9
Elk Winter Range	14.2	0.0	0.0	0.0	0.0	0.0

Upland Game Birds. Abundance of greater sage-grouse breeding in the PAPA has decreased since issuance of the PAPA ROD (BLM, 2000b). However, male attendance at leks in and outside the PAPA increased in 2005 and 2006, presumably due to heightened juvenile recruitment following 2004, a year of relatively high precipitation accompanied by beneficial sagebrush growth.

As distances between greater sage-grouse leks and drilling rigs, producing wells, and main roads have declined with the increased level of development since 2001, attendance of male greater sage-grouse at leks has declined (Holloran, 2005). The investigation by Holloran (2005) indicates that male counts on heavily impacted leks declined 51 percent, from 1 year prior to well development, through 2004. Numbers of strutting males decreased with increased traffic volumes within 1.86 miles of leks and increased noise intensity at leks (Holloran, 2005).

There are similar observations in the Powder River Basin (PRB) of northeastern Wyoming where greater sage-grouse populations on leks, subject to disturbances by coal-bed methane development, have substantially declined, relative to populations on undisturbed leks (Naugle et al., 2006). Results from studies in the PAPA and PRB indicate declining greater sage-grouse populations resulting from loss of habitat, disturbance from roads, and noise during breeding (Braun et al., 2002). Results from the PRB study indicate a time lag effect (discussed above for impact to mule deer) between the onset of wellfield development and decreasing breeding populations. For example, wellfield development in the PRB gradually increased since 1987 and greater sage-grouse attendance at leks in impacted areas dropped precipitously seven years later (Braun et al., 2002) and have further declined in the past several years (Naugle et al., 2006). Declining attendance at leks proximate to wellfield development is attributed to avoidance of the leks by yearling male greater sage-grouse (Kaiser, 2006). With low or no recruitment of yearling males, leks would eventually disappear. Once a lek has been abandoned, that vital habitat is no longer functional and has been significantly impacted.

Noise from drilling rigs can exceed 10 dBA above background noise, even if drilling is farther than 0.25 mile from noise sensitive sites such as a greater sage-grouse lek (see Section 3.12 – Noise). The 10 dBA above background limit was specified in the PAPA ROD (BLM, 2000b) as an Administrative Requirement and Condition of Approval. The PAPA DEIS (BLM, 1999a) assumed that a 0.25-mile buffer around leks was sufficient to limit noise from wellfield traffic to 10 dBA above background levels. Holloran (2005) indicates that the 0.25-mile buffer surrounding leks may be insufficient to maintain function of lek habitats due to wellfield development and associated noise.

Greater sage-grouse nesting and brood-rearing habitats have been affected by wellfield development in the PAPA. Females avoid nesting in areas of high well densities and females with broods of chick avoid well pads with producing wells (Holloran, 2005). The accumulated evidence on the effects of wellfield development on greater sage-grouse use of habitats indicate that once-functional, non-impacted habitats are less effective, given the level of development though 2005. This is because greater sage-grouse use them less over time. Function of greater sage-grouse habitat in and outside of the PAPA also appears to be affected by climatological conditions, specifically by drought. Whether the combination of effects to greater sage-grouse by wellfield disturbance and drought is synergistic or additive has not been demonstrated. However, the negative effects of one do not diminish the negative effects of the other.

Continued loss of habitat function is likely with levels of development under all of the alternatives through 2011 and under the Proposed Action and Alternative C through 2023 (Table 4.20-5). Under all alternatives, effectiveness of greater sage-grouse breeding (leks), nesting, and brood-rearing habitats would continue to decline, as they have through 2006. Declining habitat use would likely be exacerbated by continued drought. With the declines in greater sage-grouse use of the PAPA, expected through 2011, it is uncertain if habitats would still provide some function to greater sage-grouse by 2023. Habitats may not provide function even if development activities are restricted within 2-mile buffers of leks, between March 15 and July 15 (BLM, 2004c), to protect greater sage-grouse nesting habitat. Noise, traffic, and habitat elimination would all contribute to diminished effectiveness of habitats used by greater sage-grouse during winter, during breeding, nesting, and brood-rearing, through 2023. Highly impacted leks, those still active by 2006, are very likely to follow the Mesa Springs and Lovatt Draw Reservoir leks to total abandonment (as observed in 2006) even if development activities are restricted within the 2-mile buffers between March 15 and July 14 (BLM, 2004c). However, buffers of some leks would be impacted more than others. Extinction of leks would inevitably follow if yearling males do not replace aging adults at highly impacted leks. New leks may become established following extinction of former leks, such the establishment of Lovatt West and Dukes Triangle leks in 2005. Longevity of the newly established leks and their effectiveness (in terms of breeding populations), relative to extinct leks, is unknown.

Table 4.20-5
Surface Disturbances to Greater Sage-Grouse Lek Buffers by Alternative

Greater Sage-Grouse Lek Buffer	Estimated Existing Wellfield Disturbance (acres)	Potential Additional Surface Disturbance (acres) by Alternative				
		No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
0.25-Mile Buffer	56.8	26.0	95.5	91.6	204.3	198.3
2-Mile Buffer and Sage Grouse SRMZ	3,907.1	3,290.2	4,995.4	5,136.8	9,372.5	9,660.4

Other upland game birds, including mourning doves, are expected to occur in all habitats within the PAPA (see Table 3.22-15). Ruffed grouse could occur in the PAPA although they are mostly associated with aspen groves and there are only about 2 acres of aspen in the PAPA. Mourning doves may nest on the ground and surface disturbing activities could destroy nests. Increased fragmentation by road and pipeline corridors could increase nest predation, especially predation of ground nests.

Small Game and Furbearing Mammals. Diminished function in habitats utilized by cottontails is expected to occur some distance from edges created by wellfield development within sagebrush and other vegetation types. All small game mammals, furbearers, and nongame mammals are susceptible to mortality on roads. The risk of vehicle mortality of small and medium-sized mammals is expected to increase with increased traffic volumes under all alternatives, especially with increased winter traffic volumes associated with the Proposed Action Alternative and Alternative C because most of the small mammals are active during winter.

Migratory Birds. There have been concomitant declines of sagebrush-dependent migratory passerine bird species with loss of sagebrush steppe vegetation and increased fragmentation in remaining sagebrush-dominated habitats in Wyoming (Knick and Rotenberry, 1995; Knick et al., 2003). A study on the effects of wellfield roads on densities of Brewer's sparrow and sage sparrow, as well as other species dependent on sagebrush for nesting habitat, found that the density of the species was markedly reduced within 300 feet of a road compared to the density beyond that distance (Ingelfinger, 2001). Traffic accounted for some of the reduced density effects while the presence of an edge (change in vegetative type) in otherwise continuous stands of sagebrush may have had an influence. A similar reduction in sage sparrow density was observed along a pipeline alignment (Inglefinger, 2001).

As discussed earlier, edges are one component of habitat fragmentation. Fragmentation and the amount of edge between disturbed surfaces and wildlife habitat has been considerable through 2006, particularly due to wellfield roads (Table 4.20-1). A study of migratory bird populations (sagebrush obligate species) includes effects by wellfield development in the Jonah Field Project Area (King and Holmes, 2005). Results of effects of fragmentation on populations are not yet available. Amounts of fragmentation would continue to increase in the PAPA under each alternative. Declines in populations of species associated with sagebrush habitats is expected (Knick et al., 2003). Effects of fragmentation to migratory breeding birds and other wildlife (small game, furbearers, and small mammals) would increase considerably from 2006.

Raptors nesting in the PAPA are migratory birds. In addition to ferruginous hawks, merlins and burrowing owls discussed above in Section 4.19.3.1, golden eagles and other raptors nest in the PAPA and within the PAWSA (see Section 4.19, above). Monitoring data collected from 2003 through 2005 indicate that the distance of active golden eagle nests to the nearest well location varied from 895 feet to 16,582 feet with an average distance of 7,327 feet (Ecosystem Research Group, 2006). Except for short-eared owls (there is very limited data), other raptor nests in the PAPA are concentrated within forest-dominated riparian vegetation along the New Fork and Green rivers. Similar analyses of distances from active nests of other raptor species to well locations ranged from 314 feet to more than 28,500 feet, averaging 9,175 feet (Ecosystem Research Group, 2006). The large average distance between raptor nests and well locations probably is a reflection of relatively low levels of wellfield development within forest-dominated riparian zones rather than displacement of raptors away from high wellfield development (see Table 4.19-1).

Implementation of each alternative would increase disturbance within forested-dominated riparian vegetation through 2011. By 2023, increased disturbance within forested-dominated riparian vegetation would be similar under the Proposed Action Alternative and Alternative C (Table 4.19-1). Although monitoring data collected for annual raptor nesting activities has not indicated specific conflicts between wellfield development and raptor nesting success, increased disturbance within nesting habitats in the PAPA could affect at least some nests of some species, by decreasing habitat effectiveness.

Aquatic Resources. The New Fork and Green rivers support coldwater fisheries; principally rainbow trout, Snake River cutthroat trout, brown trout, and mountain whitefish. They also support limited kokanee salmon, brook trout, and lake trout. Snake River cutthroat trout and rainbow trout spawn in the spring while mountain whitefish, brook trout and brown trout are fall spawners (Baxter and Stone, 1995). In lower portions of watersheds, such as the reaches of the New Fork and Green rivers in the PAPA, high sediment loads can limit reproduction of rainbow and cutthroat trout. Sediments are mobilized during runoff from snowmelt and spring precipitation, which in the PAPA is highest during May. Increased sedimentation in the New Fork and Green rivers following spring precipitation and runoff would be most detrimental to reproduction of rainbow trout and Snake River cutthroat trout by covering spawning sites (redds) with silt, suffocating eggs, and inducing mortality of embryos developing within intergravel spaces and/or fry. Therefore, populations of fall spawning nonnative salmonids (brook and brown trout) would increase at the expense of native species (Behnke, 1992).

Surface disturbing activities that remove riparian vegetation and cause erosion and sediment transport on slopes are sources of sediment that promote degradation of aquatic environments (Reid, 1993). Surface disturbance within the forest-dominated riparian zone of the New Fork River would generate sediment into surface waters even though the amount is small compared to the estimates of new disturbance in all sub-watersheds under all alternatives (Table 4.14-1). The potential for sedimentation in aquatic habitats increases as a direct function of surface disturbance (see Section 4.14.3.1). Consequently, implementation of alternatives would increase existing surface disturbance in several sub-watersheds in the PAPA. The greatest erosion impacts occur on the Anticline Crest under all alternatives. Mack Reservoir and New Fork Alkali Creek basins show the largest increase in annual erosion over the current conditions. Erosion is increased as well in Sand Draw-Alkali Creek Basin for large storms (4.14-3). By 2023, increased surface disturbance associated with either the Proposed Action Alternative or Alternative C is expected to increase annual sediment yields to surface waters by up to 20 percent above current conditions. Depending on specific conditions in any given year, especially precipitation and runoff during spring, surface disturbance could potentially indirectly impact spawning by native salmonids.

Pipeline Corridors and Gas Sales Pipelines

Potential impacts to wildlife species from pipeline construction would be similar to impacts resulting from development within the PAPA.

Big Game. Loss of habitat function and disturbance to big game activities would occur as direct and indirect results of pipeline construction. These impacts would be limited to short-term loss of forage and short-term displacement of individuals near the construction right-of-way. Most of the pipeline construction would occur adjacent to existing pipelines and therefore, these impacts would be minimal. Long-term impacts to big game forage would not occur because the pipeline right-of-way would be reclaimed within one growing season after construction. Right-of-way maintenance would include control of noxious weeds and invasive nonnative species.

Upland Game Birds. Several greater sage-grouse leks have been identified within 2 miles of the proposed pipeline corridors. Ground disturbing activities would be avoided from March 15 through July 15 (BLM, 2004) within a 2-mile buffer of identified leks. No surface facilities would be constructed within 0.25 mile of leks. Impacts to greater sage-grouse from pipeline construction would include loss of habitat and increased habitat fragmentation. Short-term disturbance to the species and displacement of individuals could occur because of construction activities and increased human presence. These impacts are likely to reduce greater sage-grouse reproductive success and survival rates near the pipeline corridors until reclamation of shrub habitats is successful. These impacts would be localized and are not anticipated to lead to the decline of the species.

Migratory Birds. Potential impacts to migratory birds such as loss of sagebrush habitats and increased habitat fragmentation would be greater in areas of cross-country pipeline construction where the pipeline right-of-way does not parallel existing pipeline rights-of-way. One possible indirect impact would be reduced breeding success due to increased human presence. There could be direct impacts to nests and mortality to individuals as a result of construction activities. The availability of similar habitats near the proposed pipeline corridors would lessen the potential impacts to these species.

BLM imposes temporal and spatial limitations for pipeline construction activities around active raptor nest sites. Pipeline construction would not occur within 0.5 mile of active raptor nests or within 1 mile of active bald eagle or ferruginous hawk nests between February 1 and July 31. These temporal and spatial buffers may be adjusted, based on site-specific conditions. Raptor surveys would be conducted prior to commencement of construction activities from February 1 to July 31 in the nesting season. No impacts to nesting raptors are anticipated as a result of pipeline construction.

Due to the avoidance of occupied raptor and mountain plover habitats during the nesting season, migratory bird species occupying the habitats would be protected. Potential impacts to migratory birds within the proposed pipeline corridors would be localized and minor.

Aquatic Resources. Impacts to fisheries are not expected as a result of pipeline construction. The only perennial waterbodies crossed by the proposed corridor/pipeline alignments are the New Fork, Green, and Blacks Fork rivers. All of these rivers would be crossed by horizontal directional drill (HDD) construction methods. Any potential impacts to the rivers would be avoided by HDD because the pipeline would be placed beneath the rivers by drilling away from the stream banks and stream channel. There would be no excavation in the rivers or any other in-stream work.

4.20.3.2 Alternative A (No Action Alternative)

After 2006, only four new well pads would be allowed in the mostly contiguous leaseholds in the northern portion of the PAPA (currently operated by Questar) under a BLM Decision Record (BLM, 2004a). The limitation is included in the No Action Alternative. Consequently, most new wellfield roads under the No Action Alternative would be constructed in the central and southern portions of the PAPA. Under the same Decision Record, winter drilling would be allowed to continue (November 15 though April 30) on mule deer crucial winter range with up to six drilling rigs, two rigs per well pad, each year through 2011 in the mostly contiguous leaseholds. These leaseholds have, and would continue to have, a liquids gathering system servicing most producing wells. With the liquids gathering system in place, traffic in the northern leaseholds is estimated to be 0.7 vehicle/day to each producing well (see Table 3.6-5). Winter drilling traffic would exceed 66 vehicles per day to each drilling location.

Under the No Action Alternative, in the mostly contiguous leaseholds in the northern portion of the PAPA, traffic through mule deer crucial winter range would be about the same as traffic evaluated during winter 2005-2006. Mule deer avoidance of roads with very high, high, medium and low traffic volume would be similar to observed avoidance in winter 2005-2006. Mule deer would continue to avoid habitats adjacent to roads with higher traffic volumes resulting from drilling (North Anticline Road, local roads, and resource roads) by up to 3 or 4 miles.

Almost all of the mostly contiguous leasehold in the northern portion of the PAPA is within mule deer crucial winter range, and therefore, the limits on additional well pads placed by BLM (2004a) are reflected in the estimated surface disturbance in crucial winter range under the No Action Alternative. By 2011, there would be 1,090 acres of new disturbance in mule deer crucial winter range under the No Action Alternative (Table 4.20-3).

In the central and southern portions of the PAPA, no development related traffic would occur within crucial winter ranges between November 15 and April 30 under the No Action Alternative. The Operators with leaseholds in these areas would not install liquids gathering systems under the No Action Alternative, although production related traffic would continue. Estimated traffic to producing wells in crucial winter range, where there is no liquids gathering system, is 1.6 vehicles per day per producing well (see Table 3.6-5).

Although there would be no drilling related traffic in the central and southern portions of the PAPA within pronghorn crucial winter ranges during winter, the No Action Alternative would likely disturb an additional 1,500 acres of pronghorn crucial winter range (Table 4.20-2), north and south of the New Fork River. Similarly, about 250 acres of new disturbance would be within moose crucial winter/yearlong range along the New Fork River (Table 4.20-4). New producing wells in crucial winter ranges without a liquids gathering system would increase winter traffic overall.

Under the No Action Alternative, there would be 3,290 acres of surface disturbance within 2-mile buffers of greater sage-grouse leks. There are 134,283 acres in the PAPA within 2-mile buffers of all leks, and therefore, more than 5 percent of the total area within 2-mile buffers would be disturbed if disturbance is spread uniformly across the landscape.

Habitat fragmentation would increase under the No Action Alternative. Wellfield development under the No Action Alternative would generate 362 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 3,314 acres of additional surface disturbance is projected under the No Action Alternative (Table 4.16-1).

Raptors nesting in the forested-dominated riparian zone of the New Fork River would be potentially affected by 75 acres of new disturbance under the No Action Alternative (Table 4.16-1).

4.20.3.3 Alternative B (Proposed Action Alternative)

Proposed Action Alternative Through 2011

Within the first 5 years of development, through 2011, there would be an estimated 89 miles of additional roads constructed in the PAPA. Miles of new roads estimated for the Proposed Action Alternative through 2011 are nearly 20 fewer miles than for the No Action Alternative because the Operators expect to construct 179 new pads under the Proposed Action Alternative rather than 245 new pads under the No Action Alternative. In addition, 116 existing well pads would be expanded by the end of 2011. New access roads would not be required for expansion pads.

Under the Proposed Action Alternative, well drilling and completion within the CDAs (Map 4.1-3) would occur year-round within big game crucial winter ranges. Consequently, vehicular traffic during winter would be substantially greater through 2011 under the Proposed Action Alternative compared to traffic expected under the No Action Alternative.

Under the Proposed Action Alternative through 2011, there would be more than 2,200 acres of new disturbance in mule deer crucial winter range, over twice the amount disturbed by the No Action Alternative (Table 4.20-3). Under the Proposed Action Alternative, an estimated 2,400 acres and 244 acres would be disturbed in pronghorn crucial winter range (Table 4.20-2) and moose crucial winter/yearlong range(Table 4.20-4), respectively.

Declines of greater sage-grouse are expected to be more rapid and more extensive under the Proposed Action Alternative than by the No Action Alternative because winter drilling would generate noise and considerably more traffic (due to drilling and completions). This would occur even if development activities are restricted within 2-mile buffers around leks between March 15 and July 15 (BLM, 2004c). By 2011, the Proposed Action Alternative would add almost 5,000 acres of surface disturbance within 2-mile buffers of greater sage-grouse leks (Table 4.20-5). This would increase the amount of surface within 2 miles of all leks in the PAPA by more than 6.6 percent.

Habitat fragmentation (edge length) would increase with the Proposed Action Alternative through 2011, though less than with the No Action Alternative. Wellfield development under the Proposed Action Alternative is expected to generate an estimated 583 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 4,870 acres of additional surface disturbance is projected through 2011 (Table 4.16-1).

Raptors nesting in the forest-dominated riparian zone of the New Fork River would be potentially affected by 59 acres of new disturbances by the Proposed Action Alternative through 2011, less disturbance than by the No Action Alternative.

Proposed Action Alternative Through 2023

Through 2023, the Proposed Action Alternative would require an estimated total of 121 miles of new roads to access new well pads. Under this alternative, 250 new well pads would be constructed through 2017 and therefore, no new roads would be constructed after 2017. In addition to new pads, 264 existing well pads would be expanded after 2012. New access roads are not required for expansion of existing pads.

Under the Proposed Action Alternative, drilling and completions within CDAs would continue to occur year-round within big game crucial winter ranges. However, the Operators have not defined CDAs through 2023. Year-round drilling could occur anywhere within the core area as defined for the Proposed Action Alternative (Map 4.1-5). Consequently, vehicular traffic related to drilling and completions during winter would continue to be substantial as long as year-round drilling continues.

Under the Proposed Action Alternative, by 2023, nearly 3,600 acres of surface disturbance in mule deer crucial winter range and more than 2,800 acres of disturbance in noncrucial winter range are expected (Table 4.20-3). Nearly 4,400 acres would likely be disturbed in pronghorn crucial winter range (Table 4.20-2) and more than 750 acres disturbed in moose crucial winter/yearlong range (Table 4.20-4) by the Proposed Action Alternative. Operators plan to have most existing producing wells connected to a liquids gathering system within 2 years of issuance of the ROD, under the Proposed Action Alternative.

By 2023, the Proposed Action Alternative would add 9,372 acres of disturbance within 2-mile buffers of greater sage-grouse leks (Table 4.20-5), increasing the amount of surface disturbance within the 2-mile buffer of all leks in the PAPA by more than 10 percent. Noise, traffic, and habitat elimination would all contribute to diminished effectiveness of habitats used by greater sage-grouse during winter, during breeding, nesting and brood rearing and would be similar to that by Alternative C through 2023.

Habitat fragmentation would increase with the Proposed Action Alternative through 2023 and would be similar to Alternative C. Wellfield development under the Proposed Action is expected to generate more than 800 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 8,865 acres of additional surface disturbance is projected through 2023 (Table 4.16-1).

Raptors nesting in the forested-dominated riparian zone of the New Fork River would be potentially affected by 278 acres of new disturbances by the Proposed Action Alternative through 2023.

4.20.3.4 Alternative C

<u>Alternative C Through 2011</u>

Within the first 5 years of development, 2007 through 2011, the numbers of new pads and existing pads expanded would be the same as under the Proposed Action Alternative. About 89 miles of new road would be constructed in the PAPA through 2011 under Alternative C (Table 4.20-1). In 2011, the distribution of new roads under Alternative C would differ from locations of roads constructed under the Proposed Action Alternative. New road construction would be concentrated in the southern 2 miles of DA-1, within DA-2, and throughout DA-4 (Map 4.1-4). Access to these development areas during winter would be from the south, along Paradise Road and the North Anticline Road, similar to access under the No Action and Proposed Action alternatives.

No new roads are expected to be constructed during the winter in DA-3 until development in DA-2 is complete, under Alternative C. Consequently, winter traffic would be limited to production activities. Most producing wells would be connected to a liquids gathering system in DA-3 within 2 years of issuance of the ROD, further reducing winter traffic. Access to DA-3 during winter would most likely be limited to either the Boulder South Road or South Anticline Road. Access to year-round drilling in DA-4 would probably be from Highway 351 and the Jonah North Road.

Under Alternative C, drilling would occur year-round within big game crucial winter ranges on the southern end of DA-1 (mule deer crucial winter range) and in all of DA-2 (pronghorn crucial winter range). Consequently, vehicular traffic related to drilling and completions during winter would be reduced through 2011 under Alternative C on mule deer crucial winter range in the northern portion of DA-1 and on pronghorn crucial winter range in DA-3 (Map 4.1-4). Winter traffic in those winter ranges would be substantially less than traffic expected under the Proposed Action and No Action alternatives. Crucial winter habitat effectiveness in areas adjacent to wellfield activities under Alternative C, especially habitats proximate to well drilling locations in the southern end of DA-1, is expected to be considerably less than under the No Action Alternative through 2011. However, habitat effectiveness in the central and northern portions of DA-1 is expected to exceed effectiveness under the No Action Alternative because the liquids gathering system would reduce winter traffic to producing wells.

By 2011, nearly 2,100 acres of new disturbance in mule deer crucial winter range is expected under Alternative C, about twice the amount disturbed by the No Action Alternative (Table 4.20-3). Likewise, more than 2,600 acres are likely to be disturbed in pronghorn crucial winter range (Table 4.20-2) and Alternative C is expected to disturb 290 additional acres in moose crucial winter/yearlong range (Table 4.20-4). Drilling restrictions within portions of DA-1 and all of DA-3 through at least 2011 would provide some areas of lesser impact for those species. Consequently, big game crucial winter habitats within portions of DA-1 and all of DA-3 are expected to be substantially more effective and functional, at least through 2011, than under the Proposed Action Alternative.

Effectiveness of greater sage-grouse breeding (leks), nesting, and brood-rearing habitats would continue to decline through 2011 under Alternative C similar to the Proposed Action Alternative. Declines may be more rapid and more extensive under Alternative C than by the No Action Alternative because winter drilling would generate noise and considerably more wellfield traffic in the southern end of DA-1, in all of DA-2 and in DA-4. New wellfield activities would be restricted within 2-mile buffers around greater sage-grouse leks between March 15 and July 15 (BLM, 2004c) to protect leks and nesting habitats in DA-5 (Map 4.1-4). By 2011, Alternative C would add more than 5,100 acres of disturbance within 2-mile buffers of leks (Table 4.20-5), increasing the amount of surface disturbance within 2-mile buffers of all leks in the PAPA by more than 6.7 percent. Noise, traffic, and habitat elimination would all contribute to diminished effectiveness of habitats used by greater sage-grouse during winter, during breeding, nesting and brood-rearing more than by the No Action Alternative.

Levels of habitat fragmentation would increase under Alternative C similar to the Proposed Alternative through 2011. Wellfield development under Alternative C is expected to generate an estimated 585 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 4,987 acres of additional surface disturbance is projected through 2011 (Table 4.16-1).

Raptors nesting in the forested-dominated riparian zone of the New Fork River would be potentially affected by 85 acres of new disturbances to forest-dominated riparian habitat in 2011 by Alternative C, more disturbance than by No Action Alternative.

<u>Alternative C Through 2023</u>

As development is completed in the southern portion of DA-1, development in DA-1 would move to the north. By 2017, new pads and expansion pads would be concentrated in the north end of DA-1. By that time, and through 2023, winter drilling on big game crucial winter range would be limited to the north end of the PAPA within DA-1. Access to winter drilling operations on the north end of DA-1 would be from the north, rather than from the south along the North Anticline Road. Development of a transportation plan for access from the north is pending. BLM is currently working with Sublette County, WGFD, and local landowners in identifying an access route. Production activity in all crucial winter range would use access closest to any paved road from producing wells so that the limited traffic required to access producing wells in the southern end of DA-1 would be from the south.

Once all year-round drilling and wellfield development is complete within DA-2, some time after 2011, wellfield development would commence within DA-3. With no additional winter drilling allowed, winter traffic within DA-2 would be production related only. Liquid gathering systems would be in place so traffic-related disturbance within DA-2 would be minimal.

Under Alternative C, well drilling and completion would occur year-round within big game crucial winter ranges in the northern end of DA-1 (mule deer crucial winter range) and in all of DA-3 (pronghorn crucial winter range). Consequently, vehicular traffic related to drilling and completions during winter would be reduced through 2023 on mule deer crucial winter range in the southern portion of DA-1 and on pronghorn crucial winter range in DA-2 (Map 4.1-6). Winter traffic in crucial winter ranges would be substantially less than traffic expected under the Proposed Action and No Action alternatives.

By 2023, more than 3,400 acres of total new disturbance in mule deer crucial winter range are expected under Alternative C (Table 4.20-3). More than 4,100 acres are likely to be disturbed in pronghorn crucial winter range (Table 4.20-2), and 650 additional acres of disturbance is expected in moose crucial winter/yearlong range under Alternative C (Table 4.20-4).

Alternative C does not specify that new surface disturbance would occur, from south to north in DA-1 and from DA-2 to DA-3, before reclamation in those areas would be initiated. However, with all development completed in specific areas before new areas can be developed, the potential for focal points of reclamation is possible under Alternative C. That possibility does not exist under the Proposed Action Alternative. Depending on how successful future revegetation efforts would be on well pads, road and pipeline corridors during the 17-year period of wellfield development, habitat effectiveness may or may not become reestablished to levels that would increase function within big game crucial winter ranges. Winter drilling restrictions within portions of DA-1 and all of DA-2 through 2023 would provide some areas of lesser impact for those species. Consequently, big game crucial winter habitats in these areas are expected to be somewhat more effective and functional in under Alternative C than under the Proposed Action Alternative through 2023.

Winter traffic and drilling and completions in DA-3 would increase substantially once year-round drilling is complete in DA-2. Pronghorn on crucial winter ranges would be affected similarly to the effect in DA-2 during year-round drilling. Development would probably continue in DA-4 and extend into DA-5. Once there, however, Operators would be restricted by seasonal limitations on drilling between March 1 and July 15 (BLM, 2004c) to protect greater sage-grouse leks and nesting habitats.

Effectiveness of greater sage-grouse breeding (leks), nesting, and brood-rearing habitats would continue to decline through 2023 under Alternative C. Winter drilling would generate noise and development related traffic in the northern end of DA-1, in all of DA-3 and in DA-4. Wellfield development would be restricted within 2-mile buffers around leks between March 15 and July 15 (BLM, 2004c) in DA-2 and in all of DA-5 (Map 4.1-4). Alternative C is designed to protect greater sage-grouse habitats in DA-5 sufficiently to retain functional habitats through 2023. Whether that objective would be successful or not remains to be seen. By 2023, Alternative C would add 9,660 acres of disturbance within 2-mile buffers of greater sage-grouse leks (Table 4.20-5), increasing the amount of surface disturbance within the 2-mile buffer of all leks in the PAPA by more than 10 percent. Noise, traffic, and habitat elimination would all contribute to diminished effectiveness of habitats used by greater sage-grouse during winter, during breeding, nesting and brood rearing and would be similar to that by the Proposed Action Alternative through 2023.

Habitat fragmentation would increase with Alternative C at the same level as the Proposed Action Alternative, through 2023. Wellfield development under Alternative C is expected to generate more than 800 miles of new edge length (Table 4.20-1). Most new fragmentation would be within sagebrush steppe vegetation in which 9,113 acres of additional surface disturbance is projected through 2023 (Table 4.16-1).

Raptors nesting in the forested-dominated riparian zone of the New Fork River would be potentially affected by 269 acres of new disturbances to this type of nesting habitat in 2023 by Alternative C.

4.20.4 Cumulative Impacts

The CIAAs that are applicable to wildlife vary by species. The CIAA for pronghorn includes the northern portion of the Sublette Herd Unit while the CIAA for moose and mule deer are the respective species' herd units in their entireties. The CIAA applicable to greater sage-grouse includes the area encompassed by SUGMAs 3 and 7. The CIAA for all other wildlife and aquatic species is the PAPA.

Changes in land use in the region surrounding the PAPA affected wildlife and their habitats. Livestock grazing was the predominant traditional land use and is compatible with wildlife use, where appropriately managed. However, other changes in land use have occurred that affected the function of some wildlife habitats. For example, fragmentation of wildlife habitat by various developments include proliferation of roads associated with mineral resource developments (Weller et al., 2002) and subdivision of former agricultural private lands (Coupal et al., 2004 and Taylor, 2003). This fragmentation changed the landscape by removing habitat and leaving remnant areas of native habitat less functional, physically and biologically (Saunders, et al., 1991).

Fragmentation in the PAPA occurs due to human actions regardless of wellfield development. Approximately 75 miles of roads were constructed within the PAPA prior to wellfield development (Table 4.20-6). These roads include major arterial highways and a variety of collector, local, and resource roads mostly utilized by livestock operators and recreation users. Wellfield development will have increased the total edge length in the PAPA by more than an estimated 500 miles by the end of 2006. Implementation of the alternatives would substantially increase habitat edge. The estimated cumulative edge length within the PAPA would be more than 900 miles under the No Action Alternative and more than 1,100 miles under the Proposed Action Alternative and Alternative C by the end of 2011 (Table 4.20-6). By 2023, implementation of the Proposed Action Alternative and Alternative C would further increase edge length to almost 1,400 miles.

Table 4.20-6
Cumulative Existing and Potential Additional Edge Length Indicative of Fragmentation by Alternative

Component	Existing Non Wellfield Edge Length (miles)	Estimated Existing Wellfield Edge Length (miles)	Estimated Cumulative Edge Length (miles) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Well Pad Perimeter	0.0	133.6	237.9	244.9	245.5	355.3	356.1
Road Length	75.1	215.2	398.3	379.0	379.6	411.1	411.1
Pipeline Length	0.0	154.2	303.9	536.9	538.0	628.2	627.1
Total Edge Length	**75.1**	**503.0**	**940.1**	**1,160.8**	**1,163.1**	**1,394.6**	**1,394.3**

In addition to the effects of fragmentation, wildlife habitats associated with native vegetation have been altered by land uses in the PAPA (see Section 4.16.3.5). These habitats would be physically eliminated through implementation of alternatives until surface disturbances have been reclaimed. However, revegetation of surface disturbances within native vegetation will alter wildlife habitats for the life of the project, especially habitats defined by shrub and tree species.

Big Game. Pronghorn in the region surrounding the PAPA have been affected by a variety of land uses including livestock grazing, fences constructed to manage livestock, developments by mineral industries, roads, right-of-way fences, and other human developments (Lee et al., 1998; Sheldon, 2005). In the region, fences, constructed along highways (Sheldon, 2005) and associated with housing developments (Sawyer et al., 2005b), have affected pronghorn access to habitats and impede migrations between seasonally used ranges.

In addition to fragmentation and migration impediments, both of which cumulatively impact pronghorn in the Sublette Herd Unit, human developments have affected seasonal habitats utilized by pronghorn in the PAPA (Table 4.20-7). Nearly 7,500 acres of pronghorn habitats are affected by disturbances associated with non-wellfield developments including agriculture, residences, roads, urban infrastructure, and livestock facilities. Wellfield related developments in the PAPA have disturbed more than 5,000 acres. Implementation of future natural gas development in the PAPA under the alternatives is expected to increase the cumulative loss of pronghorn habitats by several thousand acres. The cumulative habitat loss, through 2011, is estimated to be more than 17,000 acres under the No Action Alternative and almost 20,000 acres under the Proposed Action Alternative and Alternative C. By 2023, it is estimated that cumulative habitat loss would be more than 25,000 acres under the Proposed Action Alternative and Alternative C (Table 4.20-7).

Table 4.20-7
Cumulative Surface Disturbance in Relation to Pronghorn Seasonal Ranges by Alternative

Pronghorn Seasonal Ranges	Existing Non Wellfield Disturbance (acres)	Estimated Total Existing Surface Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Crucial Winter Range SRMZ	1,592.9	1,619.0	4,882.6	5,808.6	5,960.4	7,719.6	7,527.7
Spring/Summer/Fall Range	5,829.7	3,440.5	11,510.3	12,944.8	12,804.6	16,467.2	16,652.3
Winter Range	44.3	0.0	44.3	44.3	44.3	44.3	44.3
Total	**7,466.9**	**5,059.4**	**17,437.1**	**19,797.6**	**19,809.2**	**25,231.0**	**25,224.2**

Mule deer habitats in the region have been affected by various past management practices and changes in land use including fire suppression, livestock grazing, residential proliferation, and barriers to migration and habitat access (Lutz et al., 2003). Similar to effects on pronghorn, human developments within the Sublette Herd Unit have affected mule deer migrations and access to seasonally used ranges, including seasonal ranges in the PAPA (Sawyer et al., 2005b).

Development not associated with wellfield activities have affected seasonal habitats utilized by mule deer in the PAPA (Table 4.20-8). More than 7,200 acres of pronghorn habitats have been affected by disturbances associated with agriculture, residences, roads, urban infrastructure, and livestock facilities. Wellfield related developments in the PAPA have disturbed an additional 2,600 acres in mule deer seasonal habitats. Implementation of any of the alternatives is expected to increase the cumulative loss of pronghorn habitats by several thousand acres. By 2011, cumulative loss of mule deer habitat associated with the No Action Alternative is estimated at more than 12,000 acres and at almost 14,000 acres under the Proposed Action Alternative and Alternative C. Estimated cumulative loss of habitat is approximately 16,000 acres under the Proposed Action Alternative and Alternative C, by 2023 (Table 4.20-8).

Table 4.20-8
Cumulative Surface Disturbance in Relation to Mule Deer Seasonal Ranges by Alternative

Mule Deer Seasonal Ranges	Existing Non Wellfield Disturbance (acres)	Estimated Total Existing Surface Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
Crucial Winter Range SRMZ	1,397.4	1,518.8	4,006.7	5,129.9	5,013.9	6,504.0	6,327.6
Spring/Summer/Fall Range	4,326.6	59.6	4,386.2	4,386.2	4,386.2	4,386.2	4,386.2
Winter Range	846.7	1,011.6	3,028.6	3,604.0	3,758.7	4,753.0	4,258.6
Winter/Yearlong Range	667.5	27.7	695.2	695.2	695.2	695.2	695.2
Total	**7,238.2**	**2,617.7**	**12,116.7**	**13,815.3**	**13,854.0**	**16,338.4**	**15,667.6**

Crucial winter/yearlong ranges in the PAPA utilized by moose in the Sublette Herd Unit are affected by 1,195 acres of surface disturbance, mostly associated with agriculture, residences, and roads unassociated with wellfield development. Existing wellfield development disturbed another 252 acres of crucial moose habitat. Cumulative effects by each alternative would increase surface disturbances to about 1,700 acres in 2011, but implementation of the Proposed Action Alternative and Alternative C would affect more than 2,100 acres of moose crucial winter/yearlong range by 2023.

Upland Game Birds. Throughout their range, greater sage-grouse have been adversely affected by habitat loss due to agriculture, energy development, rural and urban housing, and roads, as well as by habitat fragmentation from fences and powerlines (Braun, 1998). Oil and gas development, and associated infrastructure, have affected large expanses of sagebrush vegetation that supported greater sage-grouse populations (Braun et al., 2002). Changes in land uses have affected sagebrush steppe vegetation in the sage-grouse CIAA and in the PAPA. Cumulative impact to sagebrush by the alternatives is expected to be substantial (see Section 4.16.3.5).

Past human-related activities in the PAPA, unassociated with wellfield development, within various distances to greater sage-grouse leks have been relatively modest. Only 5.3 acres have been disturbed within 0.25 mile of all leks, combined and approximately 760 acres within the PAPA had been disturbed within 2 miles of all leks (Table 4.20-9). There is considerable surface disturbance associated with existing wellfield development in the PAPA, especially within 2 miles of leks (Table 4.20-9). Surface disturbance and wellfield development activities contributed to declines of greater sage-grouse in the PAPA and are discussed in Section 4.20.3.1. Cumulative surface disturbance within 0.25 mile and 2- mile buffers of greater sage-grouse leks would increase substantially with implementation of the alternatives (Table 4.20-9).

The Proposed Action Alternative and Alternative C would affect more areas within those radii than the No Action Alternative by 2011 and considerably more in 2023.

Table 4.20-9
Cumulative Surface Disturbance to Greater Sage-Grouse Lek Buffers by Alternative

Greater Sage-Grouse Lek Buffer	Existing Non Wellfield Disturbance (acres)	Estimated Total Existing Surface Disturbance (acres)	Estimated Cumulative Surface Disturbance (acres) by Alternative				
			No Action 2011	Proposed Action 2011	Alternative C 2011	Proposed Action 2023	Alternative C 2023
0.25-Mile Buffer	5.3	56.8	88.1	157.6	153.7	266.4	260.4
2-Mile Buffer and Sage Grouse SRMZ	758.9	3,907.1	8,252.9	9,958.1	10,099.5	14,335.2	14,623.1

Other Wildlife. Cumulative actions described in this section affect migratory birds (including raptors), small game mammals, furbearers, and nongame wildlife. Although monitoring efforts focused on some of these wildlife species have not revealed any effects by current wellfield development, there are no predevelopment data to compare against the monitoring data. Species' populations in the PAPA are expected to decline, with fewer unaffected habitats available, based on projected levels of development for each alternative.

Aquatic Resources. No data is available to address the potential impacts to fisheries in the New Fork and Green rivers due to surface disturbance activities that remove riparian vegetation or cause erosion and sediment transport on slopes. Existing disturbance within riparian zones, unassociated with wellfield development, is primarily associated with agriculture that limits erosion as sediment transport into aquatic habitats. Bare ground from unreclaimed wellfield development does not prevent such erosion. Increased surface disturbance caused by wellfield development in the PAPA would increase cumulative sedimentation and may adversely affect fisheries in both rivers (see Section 4.14.3.5, above).

4.20.5 Alternative Impact Mitigation

Potential measures appropriate to mitigate impact to wildlife and aquatic resources would vary by alternative as noted below:

- Under all alternatives, BLM would require the appropriate BMPs described in the Gold Book (see Section 2.4.2.1).
- Under the No Action Alternative, mitigation measures would include the appropriate sections from Appendix A in the PAPA ROD (BLM, 2000b).
- Under the Proposed Action Alternative, mitigation measures provided by the Operators in Attachments 1 through 4 in Appendix C would apply.
- Under Alternative C, BLM's Performance-Based Objectives would apply (see Section 2.4.2.4 and Appendix E).

4.21 HAZARDOUS MATERIALS

4.21.1 Scoping Issues

There are no scoping concerns related to hazardous materials.

4.21.2 Impacts Considered in the PAPA DEIS

The PAPA DEIS (BLM, 1999a) did not address hazardous materials.

4.21.3 Alternative Impacts

The same hazardous materials are expected to be present in the PAPA under each of the alternatives. Hazardous materials that have been identified by the Operators and which are expected in the PAPA some time during the life of the project are provided in Appendix C. There are requirements for reporting quantities under 40 CFR Part 355 - Emergency Planning and Notification under the Comprehensive Environmental Response, Compensation and Liability Act (CERLA) of 1980. In particular, acrylamide is listed as an Extremely Hazardous Substance utilized in drilling materials, cementing and plugging materials. Appendix A to 40 CFR Part 355 requires that users must report 5,000 pounds of acrylamide (1,000 pounds the minimum threshold planning quantity) to state/federal officials. Acrylamide is primarily used to synthesize polyacrylamide, water-soluble thickeners such as those used in drilling materials. There is evidence that exposure to large doses can cause damage to the male reproductive glands. Direct exposure to pure acrylamide by inhalation, skin absorption, or eye contact irritates the exposed mucous membranes. In addition, the acrylamide monomer is a potent neurotoxin (Merck, 2001).

4.21.4 Cumulative Impacts

Impacts from hazardous materials could result from accidental spills of hazardous materials, pipeline ruptures, and/or exposure to hazardous materials but events would be localized. Proper containment of oil and fuel in storage areas, containment of fluids in reserve pits, appropriate pipeline design and construction, proper well casing and cementing, and location of wells away from drainages would prevent potential surface water and groundwater contamination.

All existing, proposed, and future development projects in the PAPA and similar projects elsewhere in the regions would apply mandatory mitigation measures similar to those described in Appendix C (Attachment 3) to prevent pollution and exposure to hazardous materials and cumulative impacts are not expected to be significant.

4.21.5 Alternative Impact Mitigation

Project operations would comply with all relevant federal and state laws regarding hazardous materials with the directives specified in Appendix C (Attachment 3).

Chapter 5
Consultation and Coordination

5.1 LIST OF PREPARERS AND PARTICIPANTS

The list of preparers and participants, including BLM Interdisciplinary Team members and cooperating State of Wyoming and Sublette County personnel, is presented in Table 5.1-1.

Table 5.1-1
List of Preparers and Participants, Pinedale Anticline Draft SEIS
October 2006Personnel Contacted or Consulted

Name	EIS Responsibility
BLM Interdisciplinary Team	
Denver Regional Office	
Craig Nicholls	Air Quality and Climate
Paul Sommers	Water and Soil Resources
Wyoming State Office	
Roy Allen	Socioeconomics
Susan Caplan	Air Quality and Climate
Ken Peacock	State Office Project Management
Dave Roberts	Wildlife and T&E Wildlife
Rick Schuler	Water Resources
Pinedale Field Office	
Matt Anderson	Project Management
Sam Drucker	Paleontology
Merry Gamper	Natural Resource Specialist
Martin Hudson	Recreation, Noise, Visual
Bill Lanning	Supervisory natural Resource Specialist
Steve Laster	Vegetation/ T&E Vegetation
Max McCoy	Natural Resource Specialist
Karen Rogers	GIS Coordinator
Summer Schultz	Rangeland Specialist
Pauline Schutte	Wildlife and T&E Wildlife
Lisa Solberg	T&E Wildlife
Dennis Stenger	Pinedale Field Office Manageri
Dave Vlcek	Cultural and Historic Resources
Bill Wadsworth	Land Use, Transportation
Tim Zebulske	Natural Resource Specialist
Kemmerer Field Office	
Kelly Lamborn	Realty Specialist
Rock Springs Field Office	
Dennis Doncaster	Water Resources
Patricia Hamilton	Realty Specialist
State of Wyoming	
Kelly Bott	Air Quality
Mary Flanderka	Governor's Planning Office
Paige Smith	Governor's Planning Office
Darla Potter	Air Quality
Scott Smith	Wildlife
Vern Stelter	Wildlife

Name	EIS Responsibility
Sublette County	
Betty Fear	Representative for Sublette County Commissioners
Edge Environmental, Inc.	
Mary Bloomstran	Project Management
Rebecca Buseck	Wildlife, Visual Resources
Nichole Gagnon	Transportation, Document Editing
Carolyn Last	Document Review
Rosalie Massoth	Document Preparation
Josh Moro	Cultural, Grazing, Soils
Kristy Palmer	Wildlife
Archie Reeve	Project Management, Wildlife, T&E, Noise,Vegetation, Wetlands, Transportation, Hazardous Materials
Amy Thomas	Document Preparation
Joe Thomas	GIS Coordinator
Amy Thurow	Socioeconomics, Recreation, Flood Plains, Environmental Justice
TRC Environmental Corporation	
Susan Connell	Air Quality and Climate
Brian Mitchell	Air Quality and Climate
Jim Zapert	Air Quality and Climate
Norwest Applied Hydrology	
Terry Gulliver	Surface Water, Groundwater, Geology, Paleontology
HydroGeo, Inc.	
Joe Frank	Watershed Modeling
Gabrielle Walser	Watershed Modeling
French Creek Consulting	
Roger Coupal	Socioeconomics
Tom Foulke	Socioeconomics
David Taylor	Socioeconomics
Petros Environmental	
Richard Bell	Pipeline Corridors/Sales Pipelines
Chris Gayer	Wildlife, T&E

5.2 PERSONNEL CONTACTED OR CONSULTED

Personnel contacted or consulted during preparation of this Draft SEIS and scoping respondents are listed in Table 5.1-2. Table 5.1-2 also lists the names and affiliations (if known) of those who submitted written comments during the Draft SEIS comment period from October 21, 2005 through November 20, 2005 and from April 14, 2005 through May 17, 2005.

Table 5.1-2
Persons Contacted or Consulted During Preparation of the SEIS and Scoping Respondents

Agency/Organization	Individual
Alpine Geophysics, LLC	Dennis McNally
Anadarko E&P Company LP	Patrick M. Navratil
American Gas Association	
Anschutz Pinedale Corporation	Keith Bonati
Bill Barret Corporation	Duane Zavadil
Biodiversity Conservation Alliance	

Agency/Organization	Individual
BP America Production Company	Gary Austin
	Doug Blewitt
	Dave Brown
	Reid Smith
Bureau of Indian Affairs	Ray Nation
Bureau of Land Management, Kemmerer Field Office	M. Burgin
Bureau of Land Management, Rock Springs Field Office	J. D'Ewart Jim Dunder M. Kessler
Bureau of Reclamation	Beverley Heffernen
Buys and Associates	Jon Torrizo
	Doug Henderer
Colorado Department of Public Health and Environment	Roy Doyle
	Jennifer Mattox
	David Thayer
Wildlife Consultant	Art Reese
Devon Energy Corporation	Linda Guthrie
Jackson Hole Conservation Alliance	Tom Darin
Gene R. George & Associates	Gene George
Greater Yellowstone Coalition	Craig Kenworthy
Greenwood Mapping	Rich Greenwood
Independent Consultant	Doug Blewitt
Independent Consultant	Warner Reeser
IPAMS	Andrew Bremner
Jonah Gas Gathering	Michael Todd
Kemmerer Police Department	David McConkie
Lincoln County Commissioners	
Lincoln Independent School District #1	Theresa Chaulk
Memorial Hospital of Sweetwater County	D. Beltran
Mountaintop Consulting	Robin Smith
National Park Service	John Bunyak
	John Keck
	John Reber
National Resource Conservation Service	Ruben Vasquez
National Wildlife Federation	Kathleen C. Zimmerman
Petroleum Association of Wyoming	Ericka Cook
Point Reyes Bird Observatory	Aaron Holmes
Pinedale Volunteer Fire Department	Alvin Mitchell
Public Lands Advocacy	Claire Moseley
Questar Gas Management	Jimmy Druce
Questar Market Resources	Diana Hoff
	Jon Gent
	Michael Golas
	Peter Guernsey
	Jeff Ingerson
	Paul Matheny
	Jennifer Quashnick
	Jane Seiler
Rock Springs Police Department	Matt Kessler
Shell Exploration & Production Company	Aimee Davison
	Ian Foley
	JR Justus

Agency/Organization	**Individual**
Shell Exploration & Production Company	Bryan Lastrapes
	Deena McMullen
	Geoff Sell
	James Sewell
	Jacques Viret
Snowy Range Graphics	S. Trautman
Spearman Consulting Company	Margaret Spearman
State of Wyoming, Division of Highway Safety, Department of Transportation	Tom Carpenter
State of Wyoming - Office of State Lands	Lynne Boomgaarden
State of Wyoming – State Geologic Survey	Joan Binder
State of Wyoming – Governor’s Office	Governor Dave Freudenthal
State of Wyoming – WDEQ-AQD	Cynthia Madison
State of Wyoming – WDEQ-AQD	Ken Rairigh
Stop Drilling-Save the Bridger-Teton	Glenn Paulson
Stone Energy	Tracy Opp
Sublette Consolidated School District #1	Vern McAdams
Sublette Consolidated School District #9	Amy Anschutz
Sublette County Assessor	J.L. Montgomery
Sublette County Conservation District	Carrie Hatch
	Kathy Raper
Sublette County Government	Janet Montgomery
Sublette County Sheriff’s Office	Bob Hanson
Sublette County Weed and Pest	Adrianne Peterson
Sublette Emergency Medical Services	Tonya McGinniss
Sublette Rural Health Care District	T. McGinnis
Sublette Socioeconomic Analysis Advisory Committee	Jeffrey Jacquet
Sweetwater Independent School District #1	Mike Lopiccolo
Sweetwater Independent School District #2	Barbara VanMeter
Sweetwater Memorial Hospital	David Belltran
Sweetwater Sheriff Department	David Gray
Theodore Roosevelt Conservation Partnership	Steve Belinda
Trout Unlimited	Cathy Purves
Ultra Petroleum	Debra Ghani
	Tab McGinley
	Bill Picquet
	Belinda Salinas
	Mike Videtich
USDA Forest Service	Jane Darnell
	Scott Copeland
	Dave Geer
	Bud Rolafson
	Jeff Sorkin
	Terry Svalberg
Environmental Protection Agency	Joe Delwiche
	Kevin Golden
	Steve Pratt
	Larry Svoboda
U.S. Fish and Wildlife Service	Pat Diebert
	Kathleen Erwin
University of Wyoming, Department of Zoology and Physiology	Rusty Kaiser Melanie Purcell

Agency/Organization	**Individual**
Utah Department of Environmental Quality Air Quality Division	Bob Bowen
	Deborah McMurtrie
	Rick Sprott
	Teri Weiss
Western Archaeological Services	J. Stainbrook
Western Ecosystems Technology, Inc.	Hall Sawyer
Western Gas Resources	Kelly Thomas
Wildlife Conservation Society	Joel Berger
	Leigh Work
Wilderness Society	Peter Aengst
Wildlife Management	Len H. Carpenter
Wyoming Department of Agriculture	John Etchepare
Wyoming Department of Education	Matthew Willmarth
Wyoming Department of Environmental Quality Air Quality Division	Cara Keslar
	Cynthia Madison
	Andrew Keyfauver
	Ken Rairigh
Wyoming Department of Transportation	Jim Montuoro R. Maxam L. Roadifer
Wyoming Game and Fish Department	Pete Cavalli
	Dean Clause
	Susan Patla
	Dan Stroud
	Bill Wichers
Wyoming Natural Gas Pipeline Authority	Colby Dreehsel
Wyoming Oil and Gas Conservation Commission	Don Likwartz
Wyoming Outdoor Council	Bruce Pendery
	Meredith Taylor
Wyoming Wildlife Consultants LLC	John Dahlke
	Matt Holloran
Wyoming Wildlife Federation	Ben Lamb
INDIVIDUALS	
Jim Allen	Citizen
Anne Blamaceda	Citizen
Jim Bond	Citizen
Dr. John P. Bryant	Citizen
Peggy Bryant	Citizen
Jamie Burgess	Citizen
Linda J. Cooper	Citizen
Julie Degraffenreid	Citizen
Eugene Decker	Citizen
Rita Donham	Citizen
Michael Faraday	Citizen
Betty Fear	Citizen
Evangelos C. Germeles	Citizen
Elizabeth Greenwood	Citizen
Paul Hagenstein	Citizen
Hall	Citizen
Jennifer Jensen	Citizen
J. Thomas Johnston, M.D.	Citizen
Nylla Kunard	Citizen

Agency/Organization	Individual
Bob Laybourn	Citizen
Richard LaBrecque	Citizen
David A. Lien	Citizen
John Linn	Citizen
John Martin	Citizen
Bob McCarty	Citizen
Ken Meade	Citizen
Charles E. Nye	Citizen
Katherine Oberhardt	Citizen
Loren Racich	Citizen
Steve and Judy Raridan	Citizen
Barry Reiswig	Citizen
Nancy Reno	Citizen
Fred Sanchez	Citizen
Rose Sanchez	Citizen
Sylovia Mocroft Sandoval	Citizen
David Shipek and Melissa DeFoor	Citizen
Rose Skinner	Citizen
Albert Sommers	Citizen
Jonita Sommers	Citizen
Antone Spar	Citizen
Rollin D. Sparrowe	Citizen
Jeff Stinson	Citizen
Jerry E. Tully	Citizen
Steve Yenko	Citizen

Chapter 6
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Chapter 7
Glossary

abandon: To cease producing oil or gas from a well when it becomes unprofitable. Usually, some of the casing is removed and salvaged, and one or more cement plugs placed in the borehole to prevent migration of fluids between formations.

acre-foot or acre-feet (acre-ft): The volume of water that covers an area of 1 acre to a depth of 1 foot (43,560 cubic feet or 325,851 gallons).

ad valorem: Tax levied according to assessed value.

affected environment: A section in an environmental assessment or environmental impact statement that succinctly describes the environment of the area to be affected by the alternatives. (Council on Environmental Quality Regulations - 40 CFR §1502.15)

air quality: The properties and degree of purity of air to which people and natural and heritage resources are exposed (National Park Service website <http://www2.nature.nps.gov/air/AQBasics/glossary.htm>).

alkaline: Having the quality of a base (pH of 8.0 or greater).

allotment: An area of land where one or more permittees graze their livestock. Generally consists of public land but may include parcels of private or state lands. The number of livestock and season of use are stipulated for each allotment. An allotment may consist of several pastures or be only one pasture.

alluvium: Clay, silt, sand, and gravel or other rock material transported by flowing water and deposited as sorted or semi-sorted sediments.

alternate fuels: Fuels that are substantially nonpetroleum and yield energy security and environmental benefits. As defined by the Energy Policy Act of 1993, the Department of Energy currently recognizes the following as alternative fuels: Mixtures containing 85% or more by volume of alcohol fuel, including methanol and denatured ethanol; natural gas (compressed or liquefied); Liquefied petroleum gas (propane); hydrogen; coal-derived liquid fuels, fuels derived from biological materials; electricity (including electricity from solar energy); 100% biodiesel (B100).

ambient: The environment as it exists at the point of measurement and against which changes or impacts are measured.

ambient air: The portion of the atmosphere, external to buildings, to which the public has general access (National Ambient Air Quality Standards - 40 CFR §50).

ambient concentration: The mass of a pollutant in a given volume of air, typically measured as micrograms of pollutant per cubic meter of air.

ancillary facilities: Facilities often required in an oil and gas field other than the wells and pipelines, such as compressor stations.

animal unit month (AUM): The amount of forage necessary to sustain one cow/calf pair for 1 month.

anticline: A geological formation described usually as a dome or inverted saucer. If covered by an impermeable layer of rock, the anticline is a potential oil or gas reservoir.

anticline crest: A fold with strata folding downward on both sides from a common ridge. The core area where most of the development would occur within the PAPA.

Application for Permit to Drill (APD): The Department of Interior's application permit form to authorize oil and gas drilling activities on federal land or mineral estate.

aquifer: A water-bearing bed or layer of permeable rock, sand, or gravel capable of yielding water.

archaeological: The scientific studies of past people and cultures by analysis of physical remains (artifacts).

background concentration: The existing levels of air pollutant concentration in a given region. In general, it includes natural and existing emission sources but not future emission sources.

badland: Steep or very steep, commonly non-stony barren land dissected by many intermittent drainage channels. Badland is most common in semi-arid and arid regions where streams are entrenched in soft geologic material. Runoff potential is very high, and geologic erosion is active in such areas.

berm: A raised area with vertical or sloping sides.

best available control technology (BACT): It is an emission limitation that considers the cost of energy, environment, and economics in developing a degree of emission reduction that is achievable through application of good production processes, control systems, and techniques. BACT is determined on a case-by-case basis, is applied to each pollutant regulated under the Federal Clean Air Act.

calcareous: Containing calcium carbonate.

CALMET: A diagnostic 3-dimensional meteorological model.

CALPUFF: An advanced non-steady-state meteorological and air quality modeling system.

casing: Steel pipe placed in an oil or gas well to prevent the hole from collapsing.

categorical exclusions: A category of project actions, which a federal agency identifies in its NEPA procedures, that do not individually or cumulatively have a significant effect on the environment. (Council on Environmental Quality Regulations - 40 CFR 1508.4)

cement: Cement is used to "set" casing in the well bore and to seal off unproductive formations and apertures.

central gathering facility: The flowline network and process facilities that transport and control the flow of oil or gas from the wells to a main storage facility, processing plant or shipping point. A gathering system includes pumps, headers, separators, emulsion treaters, tanks, regulators, compressors, dehydrators, valves and associated equipment.

collector roads: BLM roads that provide primary access to large blocks of land and connect with, or are extensions of, a public road system.

colluvium: A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity.

completion: The activities and methods to prepare a well for production. Includes installation of equipment for production from an oil or gas well.

compression: The ratio of the volume of an engine's cylinder at the beginning of the compression to its volume at the end of the compression process.

compressor facilities (stations): A facility consisting of many compressors, auxiliary treatment equipment and pipeline installations to pump natural gas under pressure over long distances.

condensate (gas condensate): Hydrocarbons (oil) contained in the natural gas stream, often removed by condensation.

conditions of approval (COAs): A set of restrictions, or conditions, included in the approval of a federal permit, including NEPA documents.

conglomerate: Rounded water-worn fragments of rock or pebbles cemented together by another mineral substance.

corridor: A narrow strip of land.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

criteria pollutants: Air pollutants for which the EPA has established state and national ambient air quality standards. These include particulate matter (PM), nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), and volatile organic compounds (VOCs).

crucial winter range: A vital winter habitat that directly limits a community, population, or subpopulation, and restoration or replacement may not be possible by WGFD management.

crude petroleum: Either the direct or indirect liquid hydrocarbon product of natural gas production.

cultural resources: The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and the conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation.

culvert: A drain or conduit often under a road.

cumulative impact: The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taken place over a period of time (Council on Environmental Quality Regulations - 40 CFR 1508.7).

cuttings: The material removed from the borehole by the drill bit and lifted to the surface.

decibel: A unit of measurement of noise intensity. The measurements are based on the energy of the sound waves and units are logarithmic. Changes of 5 decibels or more are normally discernible to the human ear.

deciduous: Trees or shrubs that lose their leaves each year during a cold or dry season.

deciview: The unit of measurement of haze developed to uniformly describe levels of monitored and modeled visibility impairment.

direct impacts: Impacts that are caused by an action and occur at the same time and place as the action.

directional drilling: The intentional deviation of a wellbore from vertical to reach subsurface areas off to one side from the surface drilling site.

discharge: The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

dispersion: The spreading out of pollutants. Generally used to show how much an air pollutant will spread from a particular point.

displacement: As applied to wildlife, forced shifts in the patterns of wildlife use, either in location or timing of use.

disposal well: A well into which produced water from other wells is injected into an underground formation for disposal.

dissolved solids: The total amount of dissolved material, organic and inorganic, contained in water or wastes.

diversity: The distribution and abundance of different plant and animal communities and species.

drainage: Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

drill rig: The mast, draw works, and attendant surface equipment of a drilling unit.

drought: Prolonged dry weather (precipitation less than 75% of average annual amount).

ecosystem: An interacting system of organisms considered together with their environment (e.g., forest, marsh, and stream ecosystems).

emergent vegetation: Erect, rooted, herbaceous plants that project out of or emerge from the water.

emission: Air pollution discharge into the atmosphere, usually specified by mass per unit time.

endangered species (animal): Any animal species in danger of extinction throughout all or a significant portion of its range. This definition excludes species of insects that the Secretary of the Interior determines to be pests and whose protection under the Endangered Species Act of 1973 would present an overwhelming and overriding risk to man.

endangered species (plant): Species of plants in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of the destruction, drastic change, or severe curtailment of habitat or because of over exploitation, disease, predation, or even unknown reasons. Plant taxa from limited areas (e.g., the type localities only) or from restricted fragile habitats usually are considered endangered.

environment: The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

environmental assessment (EA): A concise public document that analyzed the environmental impacts of a proposed federal action and provides sufficient evidence to determine the level of significance of the impacts. (Council on Environmental Quality Regulations - 40 CFR 1508.7).

environmental impact statement (EIS): A detailed written analysis of alternative actions and their predictable environmental impacts, including physical, biological, economic, and social consequences and their interactions; short-and long-term impacts; and direct, indirect, and cumulative impacts as required by Section 102(2)(c) of the National Environmental Policy Act.

Eocene: 1) The next to the oldest of the five major epochs of the Tertiary Period in the Cenozoic Era lasting from about 54.8 to 33.7 million years ago. 2) The series of strata deposited during that epoch.

epicenter: The portion of the earth's surface directly above the focus of an earthquake.

erosion: The removal, detachment, and entrainment of earth materials by weathering, dissolution, abrasion, and corrosion, later to be transported by moving water, wind, gravity, or glaciers.

fault: A fracture in bedrock along which there has been vertical and/or horizontal movement caused by differential forces in the earth's crust.

federal lands: All lands and interests in lands owned by the U.S., which are subject to the mineral leasing laws, including mineral resources or mineral estates reserved to the U.S. in the conveyance of a surface or non-mineral estate.

field: 1) A set of rocks containing hydrocarbons. 2) An oil and gas reservoir.

flare: Process that burns and evacuates unused gases.

flood plain: That portion of a river valley, adjacent to the channel, which is built of recently deposited sediments and is covered with water when the river overflows its banks at flood stages.

fluvial: Of or pertaining to rivers.

forage: Vegetation of all forms available for animal consumption.

forb: A broad-leafed flowering herb other than grass.

formation: A rock/mineral deposit or structure covering an area with the same physical properties.

fracing (fracturing): A method of stimulating well production by increasing the permeability of the producing formation. Under extremely high hydraulic pressure, the fracturing fluid (water, oil, dilute hydrochloric acid, or other fluid) is pumped into the formation that parts or fractures it. Proppants or propping agents such as sand or glass beads are pumped into the formation as part of the fracturing job. The proppants become wedged in the open fractures, leaving channels for oil or gas to flow into the well after the hydraulic fracture pressure is released. This process is often called a “frac job.” When high concentrations of acid are used, it may be called an “acid frac job.”

fugitive dust: Airborne particles emitted from any source other than through a controllable stack or vent.

gathering pipelines: Pipelines within a field that transport gas or oil from the well to a central production facility or to the point of sale.

groundwater: Water contained in the pore spaces of consolidated and unconsolidated material.

habitat: A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

habitat function: The arrangement of habitat features and capability of those features to sustain species, population, and diversity of wildlife over time.

herd unit: A unique big game population inhabiting a specific area that is managed by the Wyoming Game and Fish Department.

horizontal directional drilling (HDD): drilling directionally at a well bore inclination angle exceeding 85 degrees. Technique used for placing pipelines under stream channels.

human environment: The factors that include but are not limited to biological, physical, social, economic, cultural, and aesthetic factors that interrelate to form the environment.

hydrocarbon: A compound formed from carbon and hydrogen, for example oil and gas.

hydrology: A science that deals with the properties, distribution, and circulation of surface and subsurface water.

hydrostatic testing: Testing of the integrity of a newly placed but uncovered pipeline for leaks. The pipeline is filled with water and pressurized to operating pressures, and the pipeline is visually inspected.

impacts: These include a) direct impacts, which are caused by the action and occur at the same time and place and b) indirect impacts, which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect impacts may include growth-inducing impacts and other impacts related to induced changes in the pattern of land use, population density, or growth rate and related impacts on air and water and other natural systems, including ecosystems. Impacts include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions which may have both beneficial and detrimental impacts, even if on balance the agency believes that the impact will be beneficial (Council on Environmental Quality Regulations - 40 CFR 1508.8).

IMPLAN (Impact Analysis for Planning): The input-output model used to estimate economic effects by tracing the interrelationships between producers and consumers in an economy as measured by jobs and income.

impoundment: The accumulation of any form of water in a reservoir or other storage area.

increment: Incremental standards (prevention of significant deterioration [PSD]) are the maximum amounts of pollutants allowed above the baseline in regions of clean air.

indirect impacts: Impacts that are caused by an action and occur later in time, or at another location, yet are reasonably foreseeable in the future. (Council on Environmental Quality Regulations - 40 CFR 1508.8).

infiltration: The movement of water or some other liquid into the soil or rock through pores or other openings.

infrastructure: The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

interdisciplinary team (IDT): A group of BLM resource specialists and possibly those from cooperating agencies selected to work within the NEPA process in scoping, analysis, and document preparation. The selection and mix of the team's disciplinary specialists is generally based on the issues and concerns identified during scoping with the purpose of integrating their collective knowledge of the physical, biological, economic, and social sciences and the environmental design arts into the environmental analysis process. Interaction among team members often provides insight that otherwise would not be apparent.

interim reclamation: Temporary reclamation initiated to stabilize disturbed surfaces on well pads, roads, and pipelines prior to final reclamation.

intermittent stream: A stream or reach of a stream that is below the local water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge.

key observation point (KOP): Established points from which viewshed analyses and visibility assessments can be made, and are an element of the BLM's visual resource management guidelines. Typically located on hilltops, popular stopping points on roads and trails, or near sensitive cultural or Native American sites.

land use: The types of activities allowed or evolved on a parcel of land (e.g., mining, agriculture, timber production, residential, industrial).

landslide: A perceptible downhill sliding or falling of a mass of soil and rock lubricated by moisture or snow.

lead agency: The agency that has primary regulatory authority and responsibility for preparing the environmental impact statement.

lease: 1) A legal document that conveys to an operator the right to drill for oil and gas. 2) The tract of land on which a lease has been obtained, where producing wells and production equipment are located.

lek: A traditional courtship display attended by male greater sage-grouse in or adjacent to sagebrush-dominated habitat. Leks are categorized as:

Active -Any lek that has been attended by male greater sage-grouse during the strutting season.

Inactive -Leks where it is known that there was no strutting activity through the course of a strutting season.

Unknown -Leks that have not been documented either active or inactive during the course of a strutting season.

Occupied -A lek that has been active during at least one strutting season within the last 10 years.

Unoccupied -There are two types of unoccupied leks: (1) Destroyed -a formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer capable of supporting greater sage-grouse breeding activity. (2) Abandoned -a lek in otherwise suitable habitat that has not been active during a consecutive 10-year period.

Undetermined - Any lek that has not been documented as being active in the last 10 years but that does not have sufficient documentation to be designated unoccupied.

life-of-project (LOP): Begins with the first disturbance authorized under the ROD for this project and ends when all wells are plugged and abandoned and all surface disturbance (each disturbed site) meets the reclamation performance objectives.

lithic scatter: A surface scatter of cultural artifacts and debris that consists entirely of lithic (i.e., stone) tools and chipped stone debris. This is a common prehistoric site type that is contrasted to a cultural material scatter (which contains other or additional artifact types such as pottery or bone artifacts), or to a camp (which contains habitation features, such as hearths, storage features, or occupation features), or to other site types that contain different artifacts or features.

lithology: The description of the physical character of a rock as determined by eye or with a low-powered magnifier, based on color, structures, mineralogical components, and grain size.

loam: A mixture of sand, silt, and clay containing between 7% and 27% clay, 28% to 50% silt and less than 50% sand.

local roads: BLM roads that provide primary access to large blocks of land and connect with or are extensions of a public road system.

long-term impacts: For the purpose of this NEPA analysis, long-term impacts last for the life of the project or beyond.

management areas: Area with specific development restrictions and limitations for resource protection. Nine management areas, authorized by the PAPA ROD exist within the PAPA.

mesa: Broad, flat-topped hill rounded by cliffs and capped with a resistant rock layer.

migrate: To pass periodically from one region or climate to another.

mitigation: Avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree of magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and/or compensating for the impact by replacing or providing substitute resources or environments (Council on Environmental Quality Regulations - 40 CFR 1508.20).

mitigation measures: Actions taken to reduce or minimize potential impacts to the environment.

modeling: A mathematical or physical representation of an observable situation. In air pollution control, models afford the ability to predict pollutant distribution or dispersion from identified sources for specified weather conditions.

Modified Mercalli (MM) Intensity Scale of 1931: A scale designed to describe the effects of an earthquake, at a given place, on natural features, on industrial installations, and on human beings.

monitor: To systematically and repeatedly watch, observe, or measure environmental conditions in order to track changes.

mud: Mud is drilling fluid that consists mainly of a mixture of water, or oil distillate, and “heavy” minerals such as bentonite or barites.

mud system: A system used to manage suspended mud in the well-drilling process.

National Ambient Air Quality Standards (NAAQS): The allowable concentrations of air pollutants in the air specified by the federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants).

National Environmental Policy Act of 1969 (NEPA): The federal law established in 1969, which went into effect on January 1, 1970, that 1) established a national policy for the environment, 2) requires federal agencies to become aware of the environmental ramifications of their proposed actions, 3) requires full disclosure to the public of proposed federal actions and a mechanism for pubic input into the federal decision-making process, and 4) requires federal agencies to prepare an environmental impact statement for every major action that would significantly affect the quality of the human environment.

National Register of Historic Places: A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

native species: Plants or animals that originated in the area in which they are found (i.e., they naturally occur in that area); with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

natural gas: Those hydrocarbons, other than oil and other than natural gas liquids separated from natural gas, that occur naturally in the gaseous phase in the reservoir and are produced and recovered at the wellhead in gaseous form.

No Action Alternative: The management direction, activities, outputs, and effects that are likely to exist in the future if the current plan would continue unchanged.

nonnative invasive species: Plant species that are introduced into an area in which they did not evolve, and in which they usually have few or no natural enemies to limit their reproduction and spread. These species can cause environmental harm by significantly changing ecosystem composition, structure, or processes, and can cause economic harm or harm to human health.

no surface occupancy (NSO): A stipulation in a lease that disallows any surface disturbance in the lease area at any time. Natural gas or oil from an NSO area, for instance, would have to be recovered by directional drilling.

Notice of Intent (NOI): A notice published in the Federal Register to announce the intent to prepare an EIS.

noxious weeds: Officially designated (State of Wyoming-designated, Sublette County-declared) undesirable or invading weedy species generally introduced into an area due to human activity.

off highway vehicle (OHV): is considered to be any type of vehicle which is capable of driving off any paved or gravel surface.

oil and gas lease: A federal oil and gas lease is a legal document that gives the lease holder the right to explore for and develop any oil and gas that may be present under the area designated in the lease while complying with any surface use conditions which may have been stipulated when the lease was issued.

operator: The company that (1) contracts to drill a well or (2) is responsible for maintaining a producing lease.

ozone (O_3): A molecule containing three oxygen atoms produced by passage of an electricalspark through air or oxygen (O_2).

paleontology: The science that deals with the history and evolution of life on earth.

particulate matter: A particle of soil or liquid matter (e.g., soot, dust, aerosols, fumes, and mist).

passerine: Passerines are the perching birds, and most are also songbirds.

perennial stream: A stream or reach of a stream that flows throughout the year.

permittee (grazing): A person who has livestock grazing privileges on an allotment or allotments within the resource area.

playa: The shallow central basin of a desert plain in which water gathers and is evaporated.

PM_{10}: Airborne suspended particles with an aerodynamic diameter of 10 microns or less.

$PM_{2.5}$: Airborne suspended particles with an aerodynamic diameter of 2.5 microns or less.

preferred alternative: The alternative identified in an EIS as the action favored by the responsible agency.

prevention of significant deterioration (PSD): A classification established to preserve, protect, and enhance the air quality in National Wilderness Preservation System areas in existence prior to August 1977 and other areas of national significance, while ensuring economic growth can occur in a manner consistent with the preservation of existing clean air resources.

PSD increments: The maximum allowable increase in pollutant concentrations permitted over baseline conditions as specified in the EPA Prevention of Significant Deterioration (PSD) regulations (40 CFR Part 52.21).

production: Phase of commercial operation of an oil field.

public land: Lands or interests in lands owned by the United States and in this case administered by the Secretary of Interior through the Bureau of Land Management, without regard to how the United States acquired ownership.

Quaternary: The latest period of time, from the present to 2 million years ago and represented by local accumulations of glacial and post-glacial deposits.

range: Land producing native forage for animal consumption and lands that are revegetated naturally or artificially to provide forage cover that is managed like native vegetation, that are amenable to certain range management principles or practices.

raptor: A group of carnivorous birds consisting of hawks, eagles, falcons, kites, vultures, and owls.

recharge: Replenishment of the water supply in an aquifer through the outcrop or along fracture lines.

reclamation: Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation, and other work necessary to restore it for use.

Record of Decision (ROD): A decision document for an EIS or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the EIS and their implementation.

reserve pit: An excavated pit that may be lined with plastic that holds drill cuttings and waste mud.

reserves/recoverable reserves: Areas of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

Reservoir: The "pool" of oil or gas that is being tapped.

resource roads: Spur roads that provide point access, as to a well site, and connect to local or collector roads.

revegetation: The reestablishment and development of self-sustaining plant cover. On disturbed sites, human assistance will speed natural processes by seedbed preparation, reseeding, and mulching.

rig: A collective term to describe the equipment needed when drilling a well.

right-of-way (ROW): The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. riparian: Land areas which are directly influenced by water. They usually have visible vegetative or physical characteristics showing this water influence. Streamsides and lake borders are typical riparian areas.

roosting: To rest or sleep in a roost. A bird will typically use the same roost for an extended period of time.

runoff: That part of precipitation that appears in surface streams. Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

salinity: 1) A measure of the amount of mineral substances dissolved in water; 2) salty.

scatter (archeological): Archaeological evidence of prior disturbance that is distributed about an area rather than concentrated in a single location.

scope: Extent or range of view.

scoping: An early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action. Scoping may involve public meetings, field interviews with representatives of agencies and interest groups, discussions with resource specialists and managers, and written comments in response to news releases, direct mailings, and articles about the proposed action and scoping meetings.

sediment: Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water or on land.

sediment load: The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

sensitive resource management zones (SRMZs): an area that contains resources that require specific surface disturbance limitations, seasonal construction constraints, monitoring, or other actions to assure that undue impacts to the resource do not occur. SRMZs occupy distinct spatial areas and in many cases, SRMZs for a number of resources overlap.

seismic: Pertaining to an earthquake or earth vibration, including those that are artificially induced.

seismic geophysical survey: A petroleum exploration method in which sound energy is put into the earth with a source. The sound energy reflects off subsurface sedimentary rock layers and is recorded by detectors on the surface of the earth. An image of the subsurface rock layers is made with seismic to find petroleum traps.

sensitive viewshed: Viewsheds that are visible from communities, public use areas, and travel corridors, including roadways and waterways, and any other viewpoint so identified through referral or planning processes.

shale: A laminated sediment in which the constituent particles are predominantly of the clay grade.

short-term impacts: For the purpose of this analysis, short-term impacts are generally defined as those that would last for 5 years or less.

shut-in: The process of stopping production at an otherwise producing well.

significant impact: A meaningful standard to which an action may impact the environment. Impact significance may be related to the context of the impact (such as society as a whole (human, national), the affected region, the affected interests, and the locality) and/or the intensity (severity) of the impact (Council on Environmental Quality Regulations - 40 CFR 1508.27).

silt Any earthy material composed of fine particles, smaller than sand but larger than clay, suspended in or deposited by water.

slope wash: Soil and rock material that is being or has been moved down a slope predominantly by the action of gravity assisted by running water that is not concentrated into channels.

socioeconomics: Study of an impact region on the current and projected population and relative demographic characteristics (housing, economy, government, etc.).

soil productivity: The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture, nutrients, and length of growing season.

spacing: The number of acres per given well in the subsurface. For instance, 160-acre spacing means that one well would be drilled in each quarter section (160 acres) or up to four wells per section (640 acres).

standard visual range (SVR): Farthest distance at which an observer can just see a black object viewed against the horizon sky. The larger the SVR, the cleaner the air.

stipulation: A legal requirement, specifically a requirement that is part of the terms of a mineral lease. Some stipulations are standard on all federal leases. Other stipulations may be applied to the lease at the discretion of the surface management agency to protect valuable surface resources. Stipulations are supported by the NEPA process; without NEPA support, a stipulation cannot be added to the lease.

strata: An identifiable layer of bedrock or sediment.

structural basin: A large depression of structural origin.

substrate: Material consisting of silts, sands, gravels, boulders, and/or woody debris found on the bottom of a stream channel.

supplemental environmental impact statement (SEIS): A supplement to either draft or final environmental impact statements prepared when 1) the agency makes substantial changes in the proposed action that are relevant to environmental concerns, and/or 2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (Council on Environmental Quality Regulations - 40 CFR 1502.9(c)).

surface disturbing activities: Any authorized action that disturbs vegetation and surface soil, increasing erosion potential above normal site conditions. This definition typically applies to mechanized or mechanical disturbance. However, intense or extensive use of hand or motorized hand tools may fall under this definition. Examples of surface disturbing activities include construction of well pads and roads, pits and reservoirs, pipelines and power lines, mining, and vegetation treatments.

Tertiary: The older of the two geologic periods comprising the Cenozoic Era; also the system of strata deposited during that period.

Tier 1-3 Standards. Federal EPA standards for new non-road (or off-road) diesel engines adopted in 1998 for engines over 37 kW (50 hp).

threatened species: Any species (plant or animal) that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

thrust fault: A low angle fault in which the rocks above the fault plane move up relative to the rocks below. The rocks that move up are the thrust sheet.

topography: The features of the earth, including relief, vegetation, and waters.

topsoil: The uppermost layers of naturally occurring soils suitable for use as a plant growth medium.

total dissolved solids (TDS): Total amount of dissolved material, organic or inorganic, contained in a sample of water.

total suspended solids (TSS): The weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles.

turbidity: A measurement of the total suspended solids.

two-track: A road that has not been constructed or maintained but that has been created by repeated use.

understory: A layer of vegetation underlying a layer of taller vegetation, such as brush and grass under trees.

vegetation type: A plant community with visually distinguishable characteristics, named for the apparent dominant species.

viewshed: The areas seen from any given point.

visibility: Refers to the visual quality of the view or scene in daylight, with respect to color, rendition, and contrast definition. The ability to perceive form, color, and texture.

visual range: The distance at which a black object just disappears from view.

visual resource: The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

> **Visual Resource Management (VRM):** A system of visual management used by the BLM. The program has a dual purpose—to manage the quality of the visual environment, and to reduce the visual impact of development activities while maintaining effectiveness in all BLM resource programs.

water recharge: The natural process whereby surface water enters a groundwater aquifer.

watershed: The total land area that drains to a given watercourse or body of water.

well or wellbore: The hole drilled from the surface to the gas-bearing formation, several of which may be developed from a single well pad.

wellfield: Area containing one or more wells that produce usable amounts of water or oil.

wellhead: The forged or cast steel fitting on the top of a well.

well pad: Relatively flat work area (surface location) that is used for drilling a well or wells and producing from the well once it is completed.

wetlands: Areas that are inundated by surface water or groundwater with a frequency sufficient to support—and under normal circumstances do or would support—a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

wilderness: A designated area defined in the Wilderness Act of 1964 in the following way: A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which – (a) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (b) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (c) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (d) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

winter range: The place where migratory (and sometimes non-migratory) animals congregate during the winter season.

Wyoming Ambient Air Quality Standards (WAAQS): The allowable concentrations of air pollutants in the air specified by the State of Wyoming. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants).

zone: The area between two depths in a well containing reservoir or other characteristic.